

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by

LEWIS STEPHEN PILCHER, M.D., LL.D.

of New York

With the Collaboration of

SIR WILLIAM MACEWEN, M.D., LL.D.

of Glasgow

W. H. CLAYTON GREENE, F.R.C.S.

of London

A GRAVIMETRIC METHOD FOR DETERMINING THE SUPERFICIAL AREA OF WOUNDS	673
BEVERLY DOUGLAS, M.D.	YALE UNIVERSITY
ACUTE HÆMATOGENOUS OSTEOMYELITIS	681
FREDERIC W. BANCROFT, M.D.	NEW YORK
TREATMENT OF AN OPEN INFECTED WOUND	701
RICHARD J. BEHAN, M.D.	PITTSBURGH
RECURRENT UNILATERAL SUBLUXATION OF THE MANDIBLE EXCISION OF THE INTERARTICULAR CARTILAGE IN CASES OF SNAPPING JAW	712
ASTLEY P. C. ASHURST, M.D.	PHILADELPHIA
TREATMENT OF CARCINOMA OF THE TONGUE	716
DOUGLAS QUICK, M.D.	NEW YORK
BENIGN STENOSIS OF THE ESOPHAGUS	724
NATHAN W. GREEN, M.D.	NEW YORK
MECHANICAL FACTORS IN THE MANAGEMENT OF RECENT EMPYEMAS	735
FRANK S. MATHEWS, M.D.	NEW YORK
CLINICALLY DOUBTFUL BREAST TUMORS: THEIR DIAGNOSIS AND TREATMENT	740
EDWIN L. BARTLETT, M.D.	SAN FRANCISCO
CULTURES FROM THE APPENDIX	749
CHARLES E. FARR, M.D.	NEW YORK
RESULTS OF TREATMENT OF TWENTY RECENT CASES OF INTRACAPSULAR FRACTURE OF THE FEMUR BY ABDUCTION AND PLASTER FIXATION	752
EUGENE C. MURPHY, M.D. AND GEORGE M. DORRANCE, M.D.	PHILADELPHIA
CANCER OF THE LARGE INTESTINE	755
JAMES I. RUSSEL, M.D.	NEW YORK
TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY	760
STATED MEETING HELD FEBRUARY 7, 1921	
TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY	773
REGULAR MEETING HELD FEBRUARY 9, 1921	
STATED MEETING HELD FEBRUARY 23, 1921	
BOOK REVIEWS	800

J. B. LIPPINCOTT COMPANY, PUBLISHERS

MONTREAL

PHILADELPHIA

LONDON

Entered at the Post-Office at Philadelphia and admitted for transmission through the mails at second-class rates.
Price, \$2.50 a year. Copyright, 1921, by J. B. Lippincott Company, 227-231 South Sixth Street.

ENDO-SODIUM IODIDE

(Asthma)

2 Grams of Sodium Iodide

ENDO

Specialties



ENDOMETHYLENAMIN

(Toxemia, Pyelitis, Cystitis)

16 Grams Hexamethylenamin



ENDOFERARSAN

(Anemias)

Iron and Arsenic



ENDOCREODIN

(Bronchial and Pulmonary Affections)

Iodides, Guaiacum, Creosote



ENDOMERSAN

(Cerebro-Spinal Syphilis)

Mercury, Dimethylarsone, Iodides



ENDOGLOBIN

(Chlorosis, Pernicious Anemia)

Haemoglobin



ENDOCAODIN

(Tuberculosis)

Calcium, Iodides, Guaiacum



ENDOARSAN

(Syphilis)

Dimethylarsone, Mercury, Iodides, Phosphorus

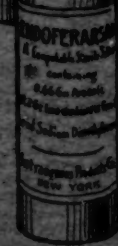


ENDOSAL

(Rheumatism)

Streptococcus Infection

Iodides, Anticollaterals, Calcium



ENDOQUIN

(Malaria)

Quinine Hydrochloride

*Purity
Safety
Efficiency*



To the modern physician, awake to the advantages of Direct Medication, we offer a complete line of pure and stable products which may be injected into the blood stream with the certainty of no untoward effects.

Send for catalogue giving complete formulæ of our specialties. Reprints of interesting articles and price list will accompany it. Correspondence is invited and will be promptly replied to by one of the physicians on our staff.

Intravenous Products Co. of America, Inc.

Manufacturing Chemists

121 Madison Avenue, New York, N.Y.

ANNALS of SURGERY

VOL. LXXIII

JUNE, 1921

No. 6.

A GRAVIMETRIC METHOD FOR DETERMINING THE SUPERFICIAL AREA OF WOUNDS

(A PRELIMINARY REPORT)

By BEVERLY DOUGLAS, M.D.

ASSISTANT RESIDENT IN SURGERY, YALE UNIVERSITY

THE contributions of Carrel, Dakin, and Dehelly in France and of the War Demonstration Hospital in New York City on the rate of wound healing as influenced by different surgical methods and various antiseptics were especially noteworthy during the war. They have emphasized the need of exact quantitative as well as qualitative standards in estimating the value of any antiseptic procedure.

In the following report a method is presented for the quantitative study of the healing of surface wounds. This, in the light of experiments made during the last eight months at the Johns Hopkins and New Haven hospitals, indicates a distinct advance in the simplification of the methods commonly employed. *Rubber protective tissue, bond paper, and a chemical balance* are the only essentials with this technic. Thus the expense and complexity of the planimetric method as employed by Carrel and du Noüy is avoided. The effort in this technic is to dispense with the planimeter and substitute for it an estimation of the area of a wound by weight, obtained by transferring its contour through carbon paper to a standard sheet of paper of known size and weight. It is then a simple matter to cut out this area from the sheet and after weighing it to determine by a simple process of proportion the exact area of the wound. The steps in the method are as follows: To obtain the contour of a wound the author recommends a thin sheet of rubber protective tissue, cello silk or cellophane film. Next sterilize the edges of the wound with alcohol, bichloride, or iodine. Place the sheet of pliable transparent material in contact with its surface. Trace the exact outline of the granulating surface or of the unpigmented epithelium with a marking pencil or pen, or cut it out directly with pointed scissors (Fig. 1). Place the pattern after cleansing it over a sheet of standard history paper or other bond paper to which its outline is traced in ink, or transferred through carbon paper. The weight of this sheet is next obtained on an accurate balance, such as one finds in any hospital, laboratory or druggist's (Fig. 2). Finally, the traced pattern is carefully cut out and weighed. With the area of the whole sheet, its weight and the weight of the cut-out pattern known, then by simple proportion: Weight of the whole sheet is to the weight of

the pattern of the wound as the area of the whole sheet is to the area of the wound. This may be expressed in the following formula:

$$WS : WCO :: \text{Area } S : CO$$

where WS = the weight of the whole sheet,
 WCO = the weight of cutout,
 S = area of the whole sheet, which is known,
 CO = the area of the cutout or the area of the wound
 to be determined.

Substituting figures, for example, from an actual case, we have

$$3.4856 \text{ gms.} : 1 \text{ gm.} :: 576.64 : CO$$

$$CO = 165.43 \text{ sq. cm.}$$

If many determinations are to be made the method is simplified by a preliminary calculation of the constant of weight per square centimetre of the paper used. This makes necessary only the weighing of the pattern of the wound to determine its area by simple division. If the wound is on a plane surface its pattern may be obtained photographically and enlarged to life size for tracing.

Two precautions should be observed in making tracings. (1) The size of paper should not be out of proportion to that of the area to be traced. The reason is obviously to avoid even the slight error due to variation in thickness of sheets. Standard typewriter size is the one usually found convenient for use on surface wounds of average size. (2) Before and during the weighing of the final tracing the latter should be protected from finger marks and dirt for, on a delicate balance, these factors introduce an appreciable error.

The tracing material must be pliable enough to conform to the irregularities of the surface. Valuable suggestions in this connection have been made by Dr. Mont R. Reid and Professor Halsted. In a test of materials for this purpose, protective rubber tissue apparently stands first in convenience; cellosilk or cellophane film rate second, while paraffine paper possesses distinct drawbacks on account of its relative inelasticity and the difficulty of marking upon it. The tracing materials are kept sterile in bichloride or other antiseptic.

Factors of Error.—It often happens that a method in the hands of one investigator yields excellent results, while in the hands of another they are not so encouraging. This may be obviated with gravimetric determinations of wound areas if one is thoroughly familiar with the possible sources of error.

The error due to variation in the thickness of various parts of the paper was first estimated by using five different bond papers chosen at random, squares of known area (25 sq. cm.) were cut from opposite corners and weighed. Though the squares were only cut by hand, their calculated and actual areas showed a difference of only 1.04 per cent. From these experiments it would appear, then, that from the variations in the thickness of individual sheets a practically negligible error may be anticipated.

DETERMINING SUPERFICIAL AREA OF WOUNDS

It is important to know, however, what variables may be obtained in using different grades and weights of papers; for naturally it is often convenient to use different kinds of paper. Six commonly employed bond papers were used to calculate unknown areas. The results in tabulated form are as follows:

TABLE I

	Known area, sq. cm.	Weight whole, grams.	Known area, sq. cm.	Calculated weight	Calculated area	Error, per cent.
O. H. Bond.....	300	1.9795	100	.6715	101.7	1.70
L. Bond.....	300	2.204	100	.7205	98.5	1.50
Ruled K. Bond.....	300	1.897	100	.6407	101.0	1.00
Ruled H. B.....	75	.483	25	.1587	24.43	2.28
L. Bond.....	75	.54025	25	.1795	24.92	.32
Ag. Bond.....	100	.558	1	.055	1.0	.00
K. Bond.....	300	2.2064	100	.7205	101.7	1.70
O. H. Bond.....	75	.503	25	.1687	24.99	.04
K. Bond.....	300	1.897	100	.6407	101.0	1.00
Average error.....	....	....	....	....	....	1.06

Here again it is noted that the error is only 1 per cent., while the maximum possible variation in this series is approximately 2 per cent.

In weighing and measuring the area of successive sheets of the same paper it was accidentally noticed that when a lot of loose sheets indiscriminately collected were used the results varied widely. The following table gives the weight variations in such a series:

TABLE II

WHOLE SHEETS

Ag. bond	Ruled K. bond	Unruled bond
3.644	4.401	5.702
3.660	4.672	5.338
3.412	4.3765	5.2755
3.405	4.220	5.335

Analysis of these variations showed that the difference in weight was due to a difference in size. The *weight, in other words, was almost exactly proportional to the size, and the variation in weight resulted from the very great inaccuracy of cutting the original sheets.* When this error was deducted, the differences due to uneven thicknesses of various sheets and different parts of the same sheet were found to be so slight that they were for all practical purposes negligible. In an effort to eliminate the error due to inaccurate cutting, a very important simplification of the method was devised. Apparently, for ordinary commercial purposes, variations in size of ordinary bond papers of 1/16 of an inch in either dimension are unimportant, and accordingly no particular care is taken in the cutting. When, however, accurately cut sheets are desired, any

first-class paper house can provide them so that they do not vary more than .04 cm. The weights correspond closely to the size.

It is this close proportion of weight to area in sheets cut with accuracy which introduced the most important simplification of the gravimetric method, *viz.*, the constant of $\frac{\text{weight}}{\text{area}}$, or weight per square centimetre.

The simple determination of this constant for a few sheets of paper reduces the calculation of the unknown area of the cut-out of a wound to a process of numerical division. If the weight per square centimetre of any paper is known, it is only necessary to weigh the cut-out tracing, and divide it by this constant to obtain the area of the pattern which is, of course, the area of the wound. In order to test the feasibility of *utilizing such a constant*, two accurately cut bond papers were employed. For our purpose, Old H 16-pound bond, costing \$6.50 per ream, gave the best results. The weights of sixteen sheets were carefully taken. The areas of each were calculated. The former divided by the latter gave the constants of $\frac{\text{weight}}{\text{area}}$, yielding an average constant of .005834 gm. per sq. cm.

of surface for this paper. The smallest constant differed from the average by less than .000072 gm.; the largest constant varied from the average by less than .000090. In measuring an area of 35 sq. cm. this would mean a maximum error of .54 sq. cm. If, for instance, an observer took the measurements and weights of any four of a series of 500 sheets, and, at the same time, should happen to select the four lightest sheets for the determination, and, in addition, should employ for his tracings the very heaviest of the remaining sheets without measuring or weighing it, his $\frac{\text{weight}}{\text{area}}$ factor would then (in the above series) be .005777, while the constant of his tracing = .005924. The error, therefore, would be .000147, amounting in a surface of 35 sq. cm. to only 2.3 per cent., or .882 cm. This would be the maximum error for any one determination.

If, on the other hand, he made two sample tracings or a series of determinations on successive sheets, the variable for the whole would be rapidly reduced to the .35 of 1 per cent. The following table emphasizes the progressive reduction of the error incurred by using a constant calculated from one to sixteen sheets:

TABLE III

Using constant calculated from	Greatest possible error
1 sheet	2.7 per cent.
2 sheets	2.6 per cent.
4 sheets	2.3 per cent.
8 sheets	2.1 per cent.
12 sheets	1.7 per cent.
16 sheets	1.5 per cent.



FIG. 1.—Method of taking a pattern of a wound surface by means of a direct cut-out from semi-transparent rubber tissue.

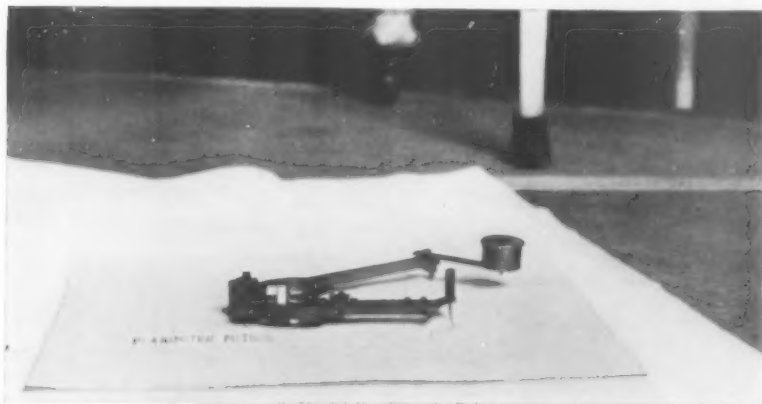


FIG. 2.—Planimeter placed upon an outline the areas of which is being estimated by its use.



FIG. 3.—The weighing of a wound pattern by the gravimetric method. The standard bond sheet from which it was cut is shown at one side.



DETERMINING SUPERFICIAL AREA OF WOUNDS

If, however, a couple of tracings from the same pattern are made on different sheets and are cut out and weighed, the average of results will reduce the possible error to 1 per cent. If four are made the error will be only .35 of 1 per cent., etc. If still greater accuracy is desired, it may be obtained by making three or four determinations of each tracing and using a sixteen-sheet constant. This will occupy only a slightly longer time. While it is possible that the accuracy may be increased by using an extremely expensive paper, the one which we have employed has failed to improve the results. If only reasonably accurate results are desired, one may compute the weight and area of only four out of five hundred sheets for the $\frac{\text{weight}}{\text{area}}$ constant, and take a single reading of the scales for each tracing.

In this study of the variables and errors inherent in the gravimetric method, it will be seen that they average a little over 1 per cent. A method, like a chain, is no stronger than its weakest link. But, as a matter of fact, the errors in the determination of wound area by this technic are less than those probable in taking the original tracing of the wound. To know what this factor might be, the following experiments were performed.

Three persons familiar with ward work traced in ink on cellosilk film the pattern of a convex cicatrizing burn in the thigh. Though the tracings were made in the same hour under similar conditions, yet the variation in results was greater than 3 per cent.

TABULATION OF AREAS OBTAINED BY THREE DIFFERENT PERSONS

No. 1	No. 2	No. 3	Greatest Variation
54.95 sq. cm.	54.68 sq. cm.	53.22 sq. cm.	3.1 per cent.

Subsequent to this one person made three consecutive tracings of a cicatrizing varicose ulcer of the leg. The results show a variation of 1.06 per cent.

TABULATION OF AREAS OF THREE TRACINGS BY ONE PERSON

No. 1	No. 2	No. 3	Greatest Variation
40.79 sq. cm.	40.36 sq. cm.	40.62 sq. cm.	1.06 per cent.

The errors of the original tracing, a stage common to estimations by both the planimetric and gravimetric methods are greater than the errors inherent in either of them. Of course, such variables may be cumulative, but it is improbable, in the ordinary laws of chance, that they would affect the results in the same way. In general one would tend to correct the other.

Comparison with Results Obtained by Planimeter.—The planimeter employed in this study for comparative area determinations by the two methods was one of the finer instruments¹ loaned by Professor Tracy of

the Sheffield Scientific School of the University. A planimeter such as that employed by du Noüy for computing the area of his tracings means an initial outlay of between fifty and sixty dollars. It is an instrument of precision and therefore requires attention to maintain its accuracy. The only apparatus required for the gravimetric method is, first, a pair of shears, and secondly, a delicate balance similar to those universally employed in hospitals, laboratories, and drug stores. A good quality of bond paper for tracings is essential to both methods.

With the planimeter one freehand tracing must be made with scrupulous accuracy. In the gravimetric determination one weighing must be done with great care. *It is much more difficult to trace accurately than to weigh accurately.* The planimeter must be set up and taken down, which would be equivalent to the time consumed by the simple arithmetical calculation necessary with the gravimetric system. The determination of the constant of $\frac{\text{weight}}{\text{area}}$ is simple if a number of sheets are weighed together and divided by the number weighed. This forms the numerator of the constant, while the average of the size of four or more accurately cut sheets forms the denominator. Once this is done enough paper is calibrated for more than an average year's work.

The gravimetric method offers one more advantage over the planimeter, *viz.*, much larger areas may be measured with equal accuracy. The planimeter will accommodate only a 10-inch square, while the gravimetric method will measure an extremely large tracing as easily and as accurately as a small.

For purposes of direct comparison six determinations made by the gravimetric method were checked with planimetric determinations. The results are given in the following table:

TABLE IV

Case	Area by gravimetric method	Area by planimeter	Percentage variation
I.			
Carbuncle of neck:			
Dec. 12, 1918.....	25.95	25.74	.9
Dec. 27, 1918.....	52.07	51.99	.16
II.			
A. J. Ulcer of leg:			
Feb. 19, 1919.....	172.40	172.77	.2
Feb. 29, 1919.....	178.75	179.55	.5
III.			
E. S. Burn arm:			
Dec. 3, 1919.....	145.85 130.09	146.96 130.19	.9 .07

These cases are cited to show that even with the crude paper and poor technic used more than a year ago, the results compared very closely

DETERMINING SUPERFICIAL AREA OF WOUNDS

with those obtained with the more expensive planimeter. In order to obtain an absolute check as to the accuracy of the two methods the following procedure was adopted: Six sheets of paper of wide variation in size and weight were selected as test sheets. With the assistance of Doctor Moise, these sheets were placed on a plane surface with a sheet of tracing paper and of bond paper under them. An arbitrary tracing with the planimeter was outlined on each one by two persons and a reading recorded for each. The copy made by the tracing paper was then carefully run over again by each observer, giving, of course, a slight difference which may be termed the error of tracing by hand with the planimeter. The dimensions of each sheet were then measured to get the area. Finally the outlined areas were cut out and weighed to determine the area by the gravimetric method.

TABLE V

TABLE OF RESULTS

No.	Absolute area, sq. cm.	Planimetric R. sq. cm.	Per cent. error	Gravimetric R. sq. cm.	Per cent. error	Difference
1	35.48	35.70	.6	35.86	1.06	
2	38.32	38.45	.4	38.02	.8	
3	124.64	125.06	.42	125.13	.45	
4	121.03	121.51	.4	122.09	.9	
5	81.93	83.48	1.9	82.74	1.0	
			Av. .74		Av. .84	.1 per cent.

This table shows that the average error in the estimation of wound surfaces varies with the gravimetric and planimetric methods by only 0.1 per cent. of 1 per cent., which is, for all practical purposes, negligible. These results were checked by two different observers working independently. It is worthy of note that the slight intrinsic error in the planimeter has not been taken into account in making these computations.

As simplicity and accuracy are always at a premium in methods that should be generally employed, their wider application will be largely commensurate with the development of an inexpensive, simple technic to determine and record the rate of healing. Carrel (1910, 1916) reports a geometric curve of cicatrization of wounds, while du Noüy (1916) gives an algebraic expression to this curve. If such quantitative studies could be more universally employed in general and hospital practice, soon an amount of data would accumulate sufficient to reduce the element of speculation in determining the action of antiseptics and in estimating the value of different methods of employing them. Much light would be thrown on such problems as the rate of healing, the influence of contraction on the healing process, and the value of different methods of skin grafting. Moreover, these results would be more generally available to the profession as a whole.

The effort in this paper has been to suggest a simple clinical method

of estimating with more or less mathematical accuracy the area of wound surfaces which might be utilized in the study of the rate of healing, the effect of antiseptics and of different surgical procedures upon wounds in facilitating the healing process. Careful studies have been made, as the above records show, of the various factors of error that can enter into the application of the method. In each case the cause of the maximum possible error has been recorded.

SUMMARY

It would appear, then, that the gravimetric method might be recommended for the following reasons:

1. The gravimetric method of determining the surface area of wounds consists of the following simple steps. The usual tracing of the exact pattern of the wound is taken by covering it with a transparent flexible sheet. This pattern is then transferred by means of tracing paper to a sheet of ordinary, accurately cut, bond paper, the weight of which per square centimetre is known. By weighing the cut-out pattern on an ordinary chemical balance and dividing the result by the constant, the exact area of the wound is obtained in square centimetres.

2. The method requires only apparatus which is ordinarily found in hospitals, laboratories, and druggist's. It is simple and requires ordinary skill and care to obtain accurate results.

3. The maximum errors of the gravimetric method are so small that they are, for practical purposes, negligible. They are less than the intrinsic error due either to tracing the wound surface on protective or to retracing this pattern on bond paper. In practice it is as accurate as the planimetric method.

To those interested in following wound healing, infection, antiseptics, and similar problems where a simple and yet accurate means of estimating wound areas is necessary, the gravimetric method offers many advantages over the planimetric method previously employed.

NOTE.—³Through the courtesy of Professor Tracy, the intrinsic error of this instrument was determined as follows: "In tracing around a three-inch square clockwise and counterclockwise and taking the average, an area of 9.00125 inches was obtained. The pointer of the planimeter was guided along the sides of the square by means of a straight-edge rule. This, of course, eliminated the usual error due to free-hand tracing."

BIBLIOGRAPHY

- Carrel: *Journal of Experimental Medicine*, 1916, vol. xxiv, p. 429.
 Carrel and Dehelly: *Treatment of Infected Wounds*. Paul B. Hoeber, New York, 1917.
 Dubois, D., and DuBois, E. F.: *Archives of Internal Medicine*, 1915, vol. xv, p. 870.
 DuNoüy: *Journal of Experimental Medicine*, 1916, vol. xxiv, p. 451.
 Meek: *Zeitschrift f. Biologie*, 1879, vol. xv, p. 425.

ACUTE HÆMATOGENOUS OSTEOMYELITIS *

BY FREDERIC W. BANCROFT, M.D.

OF NEW YORK, N. Y.

ASSOCIATE ATTENDING SURGEON, NEW YORK HOSPITAL

(From the Laboratory of Surgical Research of Columbia University)

IN acute hæmatogenous osteomyelitis in children primary operation with removal of only sufficient cortex to allow adequate drainage followed by thorough post-operative Dakinization, will frequently preserve the remaining cortex often seemingly dead. Moreover, deformity may be prevented and the period of disability shortened. Care must be taken to avoid injury of the blood supply by unnecessary curettage and packing. Our animal experiments in chemically produced osteomyelitis have suggested the possibility that any necrotic bone, if sterile, will eventually be utilized as a framework for new bone production. The late war has made the problems of chronic and traumatic osteomyelitis prominent. Little, however, has been written of the acute hæmatogenous variety prevalent in children.

Bone infections among children differ from those in adults, as the epiphysis is not yet united to the diaphysis and, therefore, the problems of therapy necessarily differ. The infection is believed by many to start in the metaphysis near the epiphysis, and then may spread either throughout the medullary cavity or Haversian canals to beneath the periosteum. It may extend to the neighboring joint by being diverted by the epiphysis through the cortex, where it travels under the capsule, or it may penetrate the epiphysis and reach the joint by this channel.

Lexer has well demonstrated the circulation of the long bones in children with radiograms by injecting the arteries with substances resistant to the X-ray (Fig. 1). His work shows very clearly that with the exception of the circumferential lamellæ, the diaphysis is almost entirely supplied through the nutrient artery, while the epiphysis and neighboring portion of the metaphysis receive an abundant blood supply from the numerous metaphyseal arteries. It is in the relatively avascular zone between the diaphysis and metaphysis (Fig. 1, c) that infection probably starts, and it is along this zone that separation frequently takes place when a sequestrum develops. It is interesting to note that the main nutrient artery entering the shaft courses away from the growing epiphysis which is most frequently involved in osteomyelitis.

In 1919 I attempted to reproduce osteomyelitis in dogs before the students of the third-year course in regional surgery at Columbia. At the suggestion of Dr. William Clarke, of the Laboratory of Surgical

* Read before the New York Surgical Society, March 23, 1921.

Research, through a drill hole in the cortex of the medullary canal of the humerus, croton oil was introduced in glass capillary tube containers having their ends sealed with agar-agar. The hole in the cortex was then plugged with bone wax, and the soft parts and the skin were sutured. By this procedure, repair, following the operative trauma, was allowed to progress before the croton oil was liberated from the capillary tube, probably by the solvent action of the cells and body fluids upon the agar-

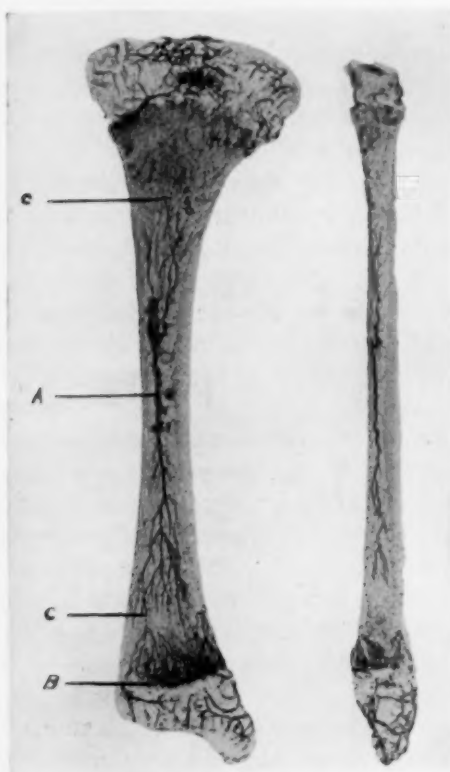


FIG. 1.—Circulation of infant's tibia and fibula. (After Lexer.) A, nutrient artery; B, metaphyseal and capsular arteries; C, relative avascular zone where sequestrum separation usually occurs.

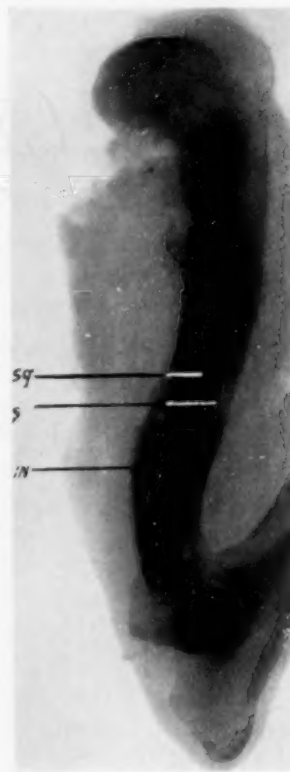


FIG. 2 (Path. No. 5665).—Operation, October 10, 1919. Procedure: Capillary tube containing croton oil inserted in medullary canal. Result: Killed November 3, 1919. Sq, sequestrum; In, involucrum; S, separation zone.

agar. As croton oil causes marked necrosis of the surrounding bone, we were able to produce a chemical osteomyelitis. A sequestrum often 5 to 10 cm. in length and including the entire circumference of the shaft frequently occurred. This sequestrum was separated from a newly formed involucrum by a zone of debris and leucocytes; therefore, all the factors of an acute osteomyelitis were present with the exception probably of bacteria and their by-products. Sections show the sequestrum with an involucrum surrounding (Figs. 2 to 7) but separated from it by a zone of pus. The cortical bone of sequestrum shows absence of nuclei and

ACUTE HÆMATOGENOUS OSTEOMYELITIS

throughout its cancellous portion there is a marked infiltration of leucocytes. The involucrum consists of newly formed subperiosteal bone.

In the prolonged animal experiments radiographic studies show the gradual disappearance of the sequestrum (Figs. 8 to 10), so that at the end of two months it was impossible to detect its former outlines by X-ray. Microscopical sections (Figs. 11 and 12) taken at this time show the disappearance of the zone of separation, and the former sequestrum is now united to the living bone by blood-vessels entering the Haversian

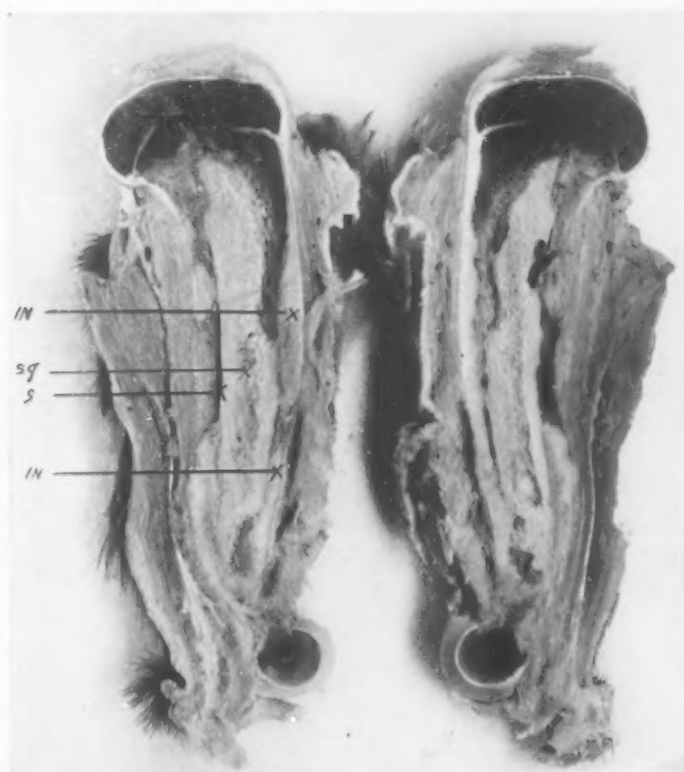


FIG. 3 (Path. No. 5665).—Photograph of cross section. Massive sequestrum extending almost the entire length of shaft. *Sg*, sequestrum; *In*, involucrum; *S*, separation zone.

canals. The process is similar to that found in any bone transplant; gradual absorption and deposition of new bone occurring throughout the Haversian canals until all the dead bone has been replaced.

I have emphasized these facts because I believe they have a definite influence on human surgery. I shall show in the study of clinical cases that in children bone tissues that are apparently dead can be saved to advantage.

During the last five years we have had eleven cases of acute osteomyelitis in children on Doctor Pool's service at the New York Hospital. It has been possible to follow these cases and to observe the results of

treatment. Trauma was the most prominent etiological factor in our series. Six or 60 per cent. received injuries varying from ten hours to two weeks before the onset of the acute process. That trauma and the presence of bacteria in the blood-stream can cause osteomyelitis in animals has been demonstrated by Lexer and others. We have produced it in

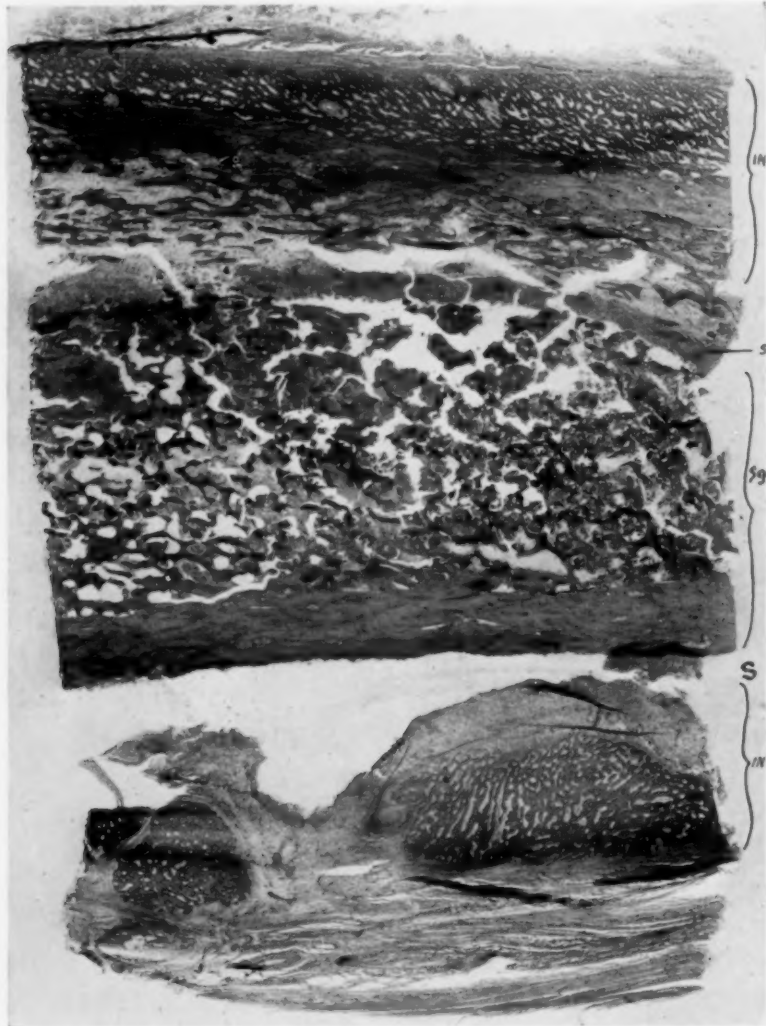


FIG. 4 (Path. No. 5665).—Microscopic section. In the lower zone of separation necrotic debris disappeared during decalcification. *Sg*, sequestrum; *In*, involucrum; *S*, separation zone.

rabbits in the Surgical Research Laboratory by traumatizing the leg without breaking the skin, and injecting into the veins of the ear a strain of staphylococcus from a case of human osteomyelitis, which had subsequently been transmitted through rabbits. On sectioning the femur, which had been fractured by the force of the blow, there was a marked

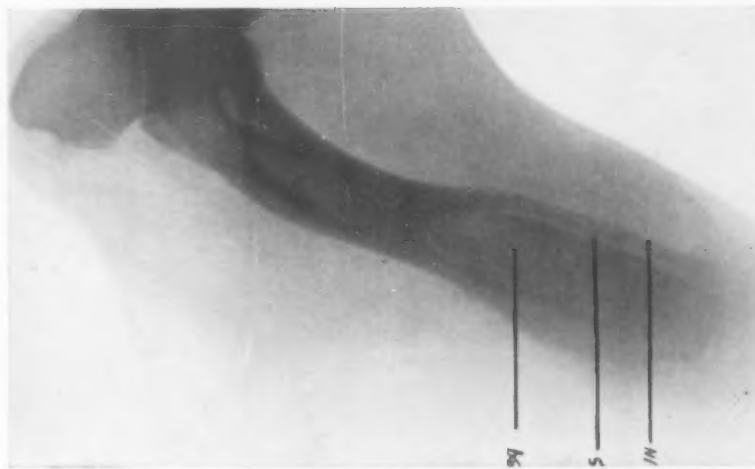


FIG. 5 (Path. No. 6692).—Operation September 21, 1920. Procedure: Capillary tube containing croton oil inserted in medullary canal. X-ray, October 15, 1920, shows large sequestrum in upper half of humerus. Sq, sequestrum; In, involucrum; S, separate zone.



FIG. 6 (Path. No. 6692).—X-ray November 17, 1920. Marked subperiosteal bone proliferation with sequestrum, but small zone of separation.

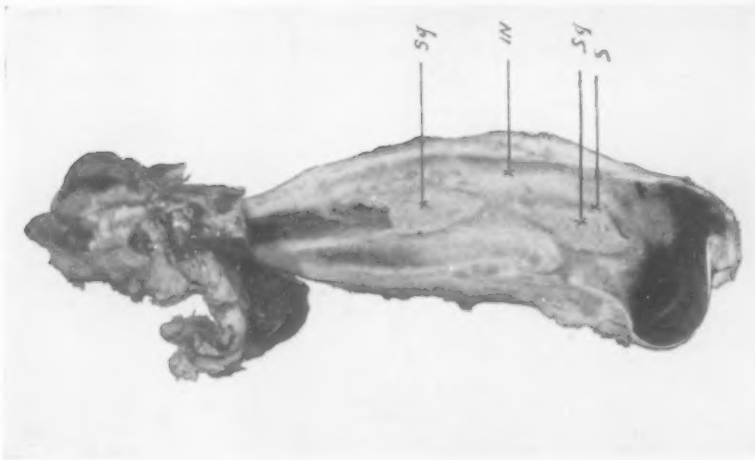


FIG. 7.—Photograph of cross section of No. 6692. Massive sequestrum with thick involucrum and zone of separation. Sq, sequestrum; In, involucrum; S, separation zone.

exudation of pus-cells at the epiphysis and in the medullary canal. The short period of ten hours, between the time of the injury and the apparent onset of the infection in children, has suggested to me that the disease may be due to bacterial emboli locating in the traumatized small vessels near the termination of the nutrient artery on the diaphyseal side of the

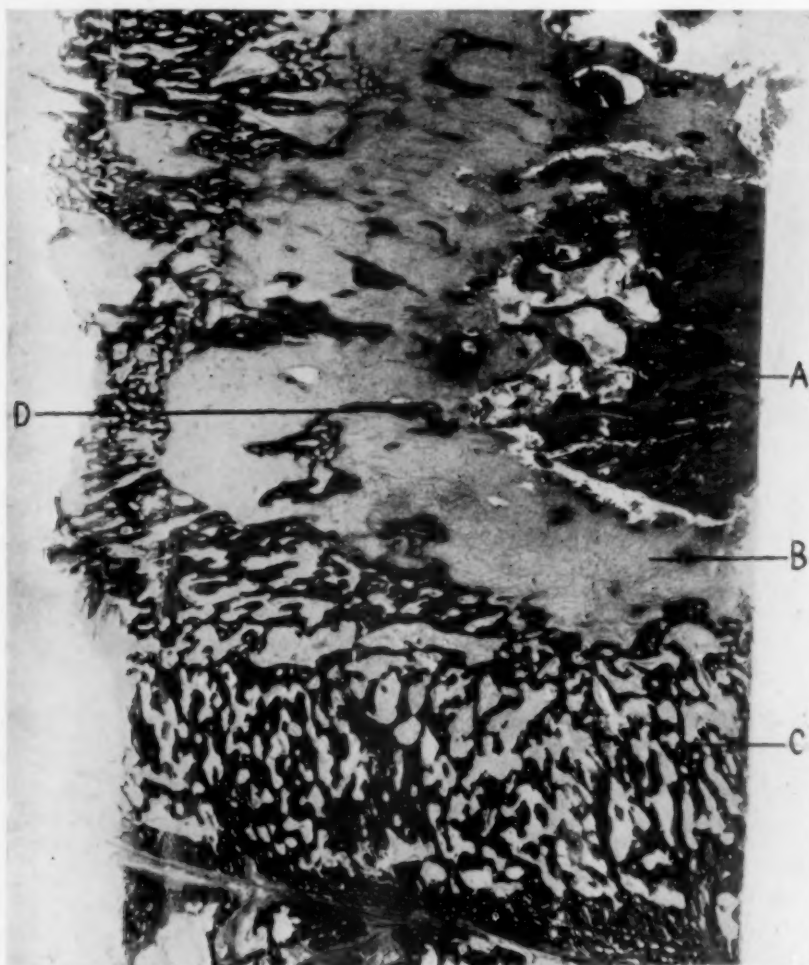


FIG. 7A (Path. 6692).—Lower power view of terminal portion of sequestrum with surrounding involucrum. A, sequestrum; B, granulation tissue; C, involucrum; D, terminal spicule of sequestrum shown under high power in Fig. 7B.

epiphysis (Fig. 1, c). Three cases developed without any history obtainable of previous injury or infection. A recent tonsillitis might be assumed to be the etiological factor in one case.

The tibia was involved five times, four in the upper portion of the shaft and once in the lower. The femur was involved four times in the region of the lower epiphysis. The ulna once at the epiphysis. The neighboring joints were definitely infected in four cases. Metastatic

ACUTE HÆMATOGENOUS OSTEOMYELITIS

joint involvements occurred in one case where the hip on the opposite side and the elbow on the same side were severely infected. One case of double suppurative parotitis developed. Three patients developed metastatic osteomyelitis in long bones in addition to the primary focus. All the patients showed signs of severe infection, high temperature and



FIG. 7B (Path. 6692).—Terminal portion of sequestrum showing new bone formation about it, and gradual reorganization. A. Dead bone, cell spaces are empty, showing no nuclear stain; B, newly formed bone surrounding and incorporating dead bone.

pulse-rate, prostration, and all but one case had a high leucocytosis varying from 20,000 to 44,000.

No amputations were done in any of this series.

There was swelling and cedema of the soft parts in ten cases. Bone tenderness on pressure was noted in nine cases and was absent in two cases. Swelling about the neighboring joint was noted in six cases, with limitation of motion in four.

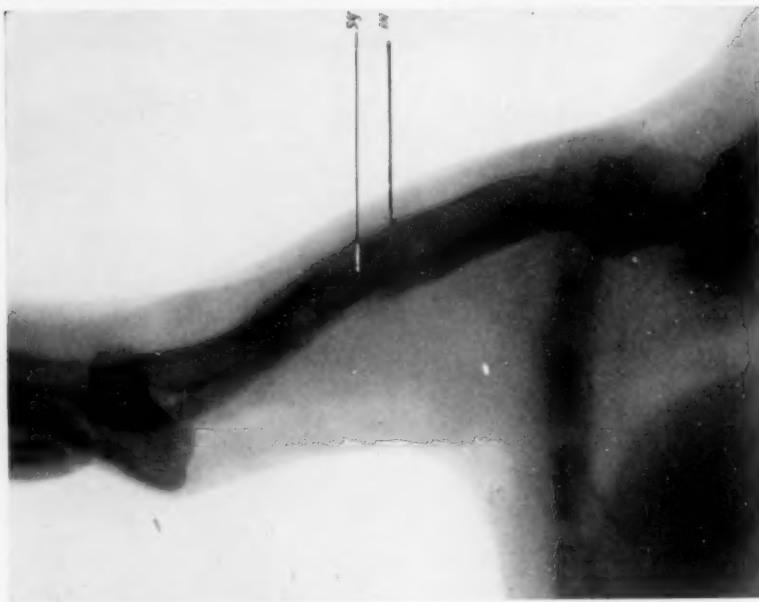


FIG. 9 (Path. No. 5942).—X-ray December 1, 1919. Sequestrum and involucrum, but less marked than previous. *In*, involucrum; *Sg*, sequestrum.

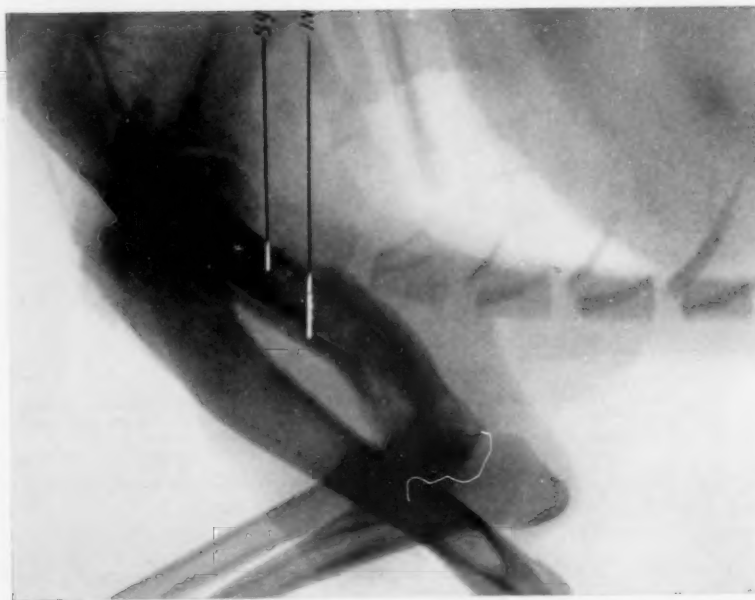


FIG. 8 (Path. No. 5942).—Operation October 10, 1919. X-ray November 10, 1919. Large sequestrum with well-marked involucrum and separation zone. *In*, involucrum; *Sg*, sequestrum.

ACUTE HÆMATOGENOUS OSTEOMYELITIS



FIG. 10 (Path. No. 5942).—X-ray January 15, 1920. No involucrum or sequestrum seen.

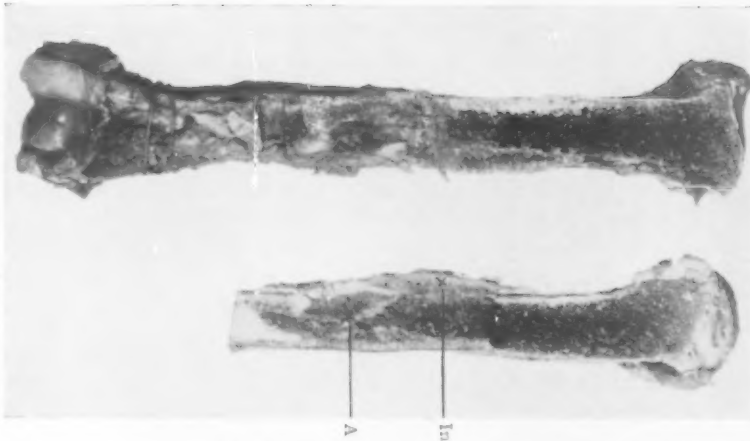


FIG. 11 (Path. No. 5942).—Killed January 24, 1920. Photograph of cut section. In, subperiosteal bone proliferation; A, probable remnants of old sequestrum, but no separation zone.



FIG. 12.—Microscopic section (Path. 5942). Subperiosteal bone proliferation. No zone of separation. A, spaces in which capillary tube lay. B, artifact occurring during decalcification.

There was one death, a boy of seventeen years, with osteomyelitis of the femur, who died twenty-four hours after admission from sepsis and cardiac failure. He had a low leucocyte and high differential count.

Follow-up.—Two cases have been lost track of after having been followed for about two years. One of these at that time had a small persisting sinus, the other was well.

The remaining cases have been followed from one to five years and are well. Two cases with joint involvement where the joint was drained now have ankylosis, one a knee- and the other a hip-joint.

The treatment of acute osteomyelitis in children may properly be divided into the treatment of the acute, and secondly, treatment at the subacute stage. Primary indication for operation at the onset is the relief of pus under pressure, and as such, it should be treated with the same surgical principles as pus collections elsewhere in the body; that is, by adequate drainage, with the least possible trauma and with careful attention to the blood supply. If one considers that frequently periosteum with its blood supply has been stripped from the shaft by the exudation of pus and that the only remaining blood supply to the shaft is through the nutrient artery, one realizes the danger to the entire shaft from too active treatment by curettage or packing.

It is true that in the region of the metaphysis, the bony septa somewhat resembles the septa of the mastoid, and that, therefore, in this region it may be necessary to break up the compartments of the abscess. Care even here should be taken not to traumatize any more than possible.

Simmons, of the Massachusetts General Hospital, has suggested making numerous burr holes through the cortex into the medullary canal as the preliminary drainage. This undoubtedly suffices in certain cases. It is difficult to determine the extent of the process by this method, and with post-operative Carrel-Dakin treatment it is probably more conservative to remove more of the cortex in order to obtain adequate exposure and drainage.

The frequent occurrence of metastatic abscess in the region of the popliteal space, when the lower epiphysis of the femur or upper epiphysis of the tibia is infected, has convinced me that a primary dependent drainage through the popliteal space is in general advisable.

Constant, careful post-operative observation of these cases is necessary, as there are frequent secondary metastatic abscesses in the soft parts. The eventual cure of the patient is due to the careful treatment of the interne performing the Carrel-Dakin technic.

The joint infections frequently showing the presence of staphylococcus aureus are usually amenable to aspiration and irrigation. In our four cases where there was either primary or immediate joint involvement, two cleared up under irrigation and two joints had to be drained. I feel certain that in one of our early cases where the knee-joint was drained it would have been better surgery if aspiration had been attempted.

ACUTE HÆMATOGENOUS OSTEOMYELITIS

In cases where septicæmia and bacteræmia are present, it is necessary to attempt to keep up the nutrition of the patient. In addition to transfusion we have found most advantageous the repeated intravenous injection of commercial peptone as advised by Nolf, of Liège. In one child with streptococcus hæmolyticus blood infection, at Doctor Pool's suggestion, we used this method, with an immediate drop in temperature, consequent improvement in the child's general condition, and within ten days the culture was sterile.

Subacute Stage.—Before the days of wound sterilization the course of a case could be fairly definitely prophesied. At the primary operation, the shaft was opened wide, frequently curetted and packed. Following this, sequestration occurred, frequently involving almost the entire shaft. As advised by Nichols, of Boston, the sequestrum was usually removed at a time when the involucrum was strong enough to maintain the shape of the limb, and yet at such a stage when the involucrum could be inverted, obliterating, as far as possible, the "dead space."

With the introduction of the Carrel-Dakin technic up to date clinically we have had results which correspond to a certain degree with results found in our experimental work. Cases No. IX and No. X of this series show marked regeneration of bone which by either X-ray or gross examination appeared necrotic.

On account of limited space brief summaries of only three illustrative cases will be given.

CASE I.—Girl of eight years of age, admitted May 5, 1915, with history of having fallen and injured her left knee four days previous. She complained of severe pain when she attempted to walk. Ten hours after injury the knee was considerably swollen and the child cried with pain on any motion. Examination revealed a knee-joint markedly red, swollen and exquisitely tender. Active and passive motion practically nil. Some swelling in the popliteal space. The knee-joint was at first operation drained and a quantity of pus obtained. Later she developed an osteomyelitis of the lower end of the femur and several operations were done, removing the necrotic bone and draining the abscesses in the soft parts. Following the fourth operation she received a fracture at the epiphysial line and marked displacement (Figs. 13 and 14). During this time she had been extremely ill, with a very high temperature, and her recovery at one time was despaired of. On leaving the hospital she had a shortening of two and one-half inches, fixation of the knee-joint and persistent sinus. At the present time she still has a shortening of two and one-half inches, but otherwise is perfectly well, is able to run, dance, and has not had a sinus for over three years.

Comment.—This patient, with a marked deformity and necrosis of the shaft, attained a very satisfactory functional result; new bone proliferating in such a manner as to change the lines of force and give her a straight leg.

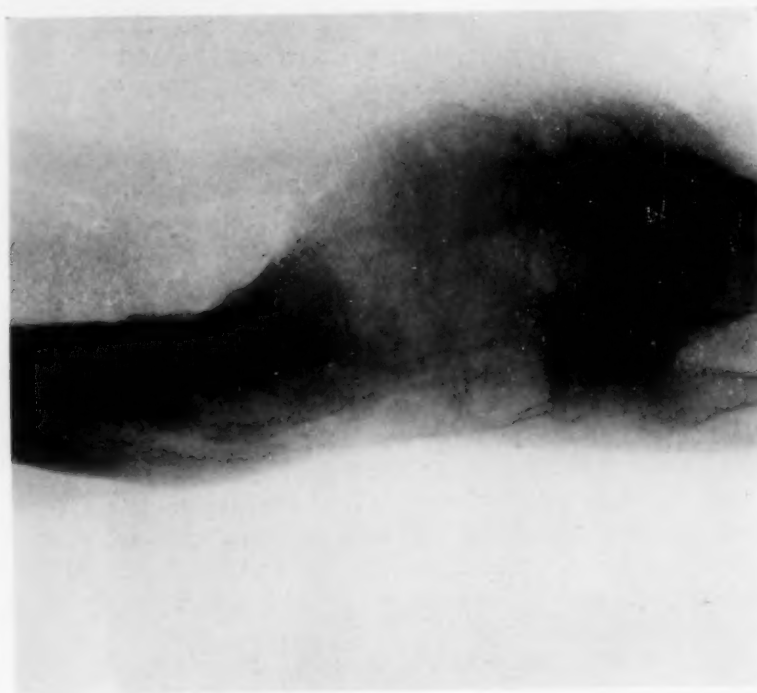


FIG. 14.—Clinical case No. 1, June 5, 1916. Shows reformation of bone. No sinus.

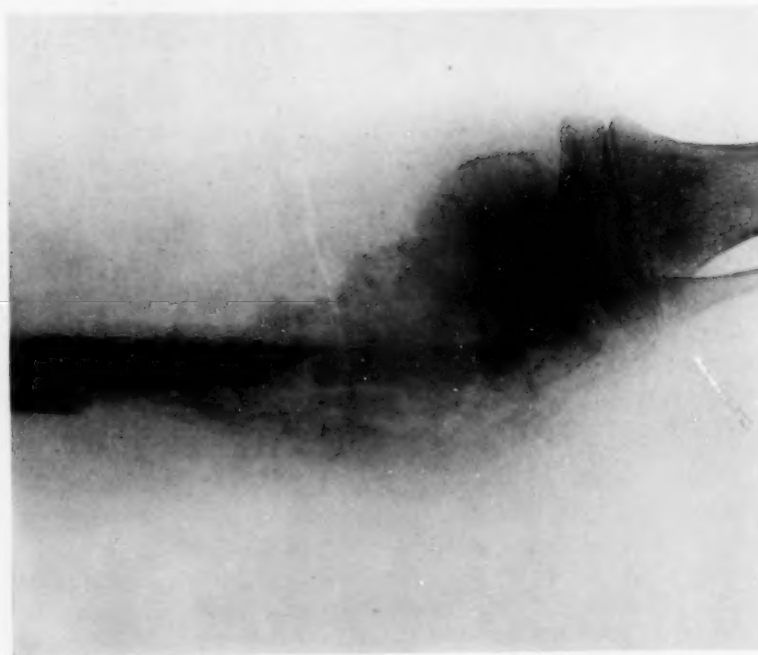


FIG. 13.—Clinical case No. 1 (see case history). Marked destruction of shaft with the fracture at the epiphyseal line and displacement, July 12, 1915.



FIG. 15.—Clinical case No. 9. X-ray July 30, 1919. Operation June 22, 1919. Removal two inches of anterior surface upper third of tibia. A, area of bone removed at primary operation; In, involucrum; S, separation zone.

In Case IX (Figs. 15 to 18), a girl of five years, who came into the hospital with an acute osteomyelitis involving the upper third of the tibia, drainage was established by removing the anterior part of the cortex in the upper third. Later X-ray showed a marked rarefaction and apparent sequestrum formation in the lower third. As her temperature was approaching normal, and her condition



FIG. 16.—Clinical case No. 9. Operation June 22, 1919. X-ray, August 22, 1919. S, former separation zone. Marked subperiosteal proliferation. No operative procedure has been performed on this area.

quite satisfactory, it was considered advisable to delay operation upon the lower third. Later X-ray showed subperiosteal bone proliferation around this zone of separation, and an X-ray one year later showed a relatively normal appearing shaft. At the present time she is well, without any sinus, and apparently the process is cured.



FIG. 17.—Clinical case No. 9. Operation June 22, 1919. X-ray, Oct. 27, 1919, shows bone proliferation. No sign of sequestrum.

Comment.—Primary radiographic studies of this patient showed the appearance of rarefaction and sequestration in the lower third of the tibia. This completely disappeared without any operative interference.

Case X (Figs. 19 to 22), a boy seven years old, who elsewhere had been insufficiently drained for an acute osteomyelitis of the tibia,

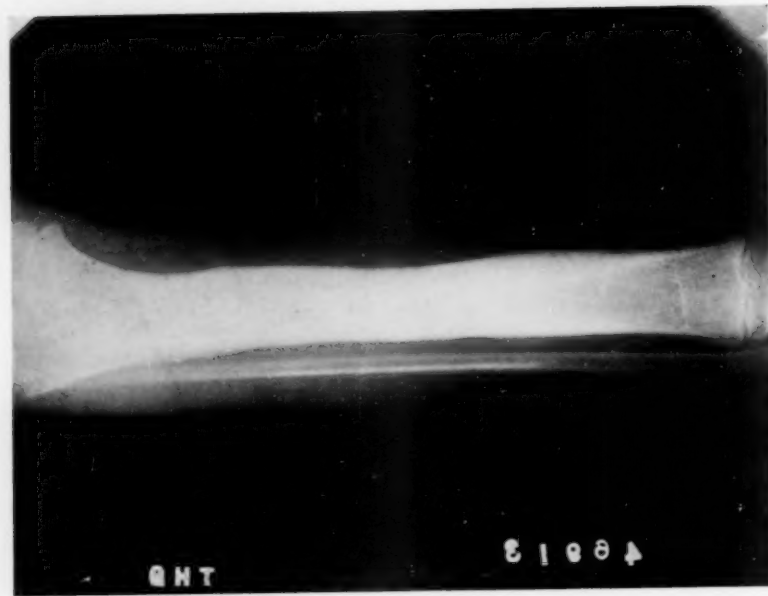


FIG. 18.—Clinical case No. 9. Operation June 22, 1919. X-ray November 24, 1919. No sinus. Patient apparently well.

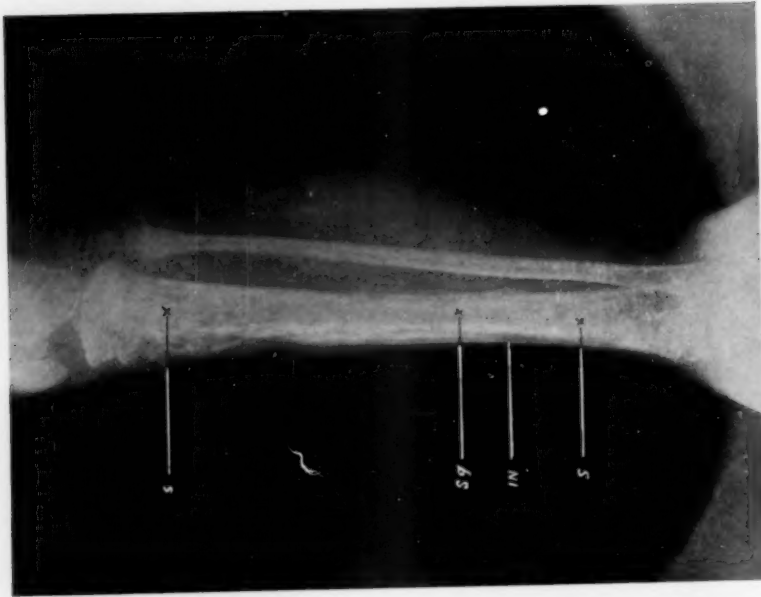


FIG. 19.—Clinical case No. 10. X-ray December 8, 1919. previous to operation. *Sq*, sequestrum; *In*, involucrum; *S*, separation zone.

ACUTE HÆMATOGENOUS OSTEOMYELITIS

came into the hospital extremely ill, with a temperature of 106° , marked leucocytosis and prostration. At the primary operation the entire anterior portion of the cortex of the tibia was removed. There was a fracture of the upper third due to the complete destruction of the bone. Periosteum was separated by pus from the greater part of the shaft. In this case Carrel tubes were inserted posteriorly between the necrotic shaft and the periosteum. The shaft appeared dead. It was not removed because it was thought advisable to maintain this portion of the shaft to prevent deformity. This was



FIG. 20.—Clinical case No. 10. X-ray February 7, 1920. Operation December 9, 1919. Anterior surface of the cortex of the tibia removed. Drainage tube in popliteal space shown. See case history.

the child who had a streptococcus hæmolyticus blood infection and was treated with intravenous injections of peptone. After about five weeks, granulations were seen springing up on the surface of the formerly necrotic shaft. X-rays taken two months after the primary operation showed new bone formation about and apparently incorporating the remnant of the old necrotic shaft. At the present time the patient has a small discharging sinus in the upper third, but the X-rays showed marked new bone proliferation without the sign of any sequestrum.

Comment.—This patient, who was too sick to stand any opera-



FIG. 21.—Clinical case No. 10. X-ray April 10, 1920. New bone proliferation about and incorporating former dead shaft.

ACUTE HÆMATOGENOUS OSTEOMYELITIS



FIG. 22.—Clinical case No. 10. X-ray October 18, 1920. New bone formation. Small sinus in upper third, otherwise healed. Patient walking on leg. Feels well.

tive procedure, had a dead shaft exposed in the wound. After Dakinization, granulation tissue appeared on the former necrotic surface. The bone was later incorporated and the new bone formed about it.

Whether or not in this case the sequestrum was sterilized by the Dakin solution it is difficult to state, but it appears as if it were acting very much as the chemical sequestrum produced by croton oil injections in the experimental laboratory.

Finally, because the whole problem is unsolved concerning the changes which take place in bones, seemingly dead, in the process of repair, this is not a consideration of biological bone changes. These statements are observations of clinical facts, conclusions upon operative findings, and subsequent results of Dakin treatment.

Therefore, from the experience obtained by these cases and from the many animal experiments, I am convinced that in the future in the treatment of children, we can be more conservative, as follows:

First. Adequate drainage should be obtained with as little trauma as possible.

Second. In cases where the patient is clinically progressing favorably, bone, which by X-ray or gross examination appears dead, may frequently be saved to advantage in order to prevent deformity and hasten convalescence.

TREATMENT OF AN OPEN INFECTED WOUND

By RICHARD J. BEHAN, M.D.

OF PITTSBURGH, PA.

SURGEON TO ST. JOSEPH'S HOSPITAL

EVERY closed wound at some time in its development becomes converted from a closed into an open wound. By this is meant any wound which has a communication, directly or indirectly, with the external surface of the body.

The treatment of a non-infected open wound is the same as that of an infected open wound, after the infecting agency has been overcome. The healing reactions from this time in both types of wounds are somewhat similar, with this important exception; namely, that the amount of destroyed and devitalized tissue in an infected wound which has been aseptized is much greater than in a primary non-infected wound. The most beneficent effect upon the organism, when the suppurating non-open wound becomes a suppurating open wound is that the absorption of toxins which had previously in the closed suppurating wound been most active is now minimized. The active absorption in a progressing closed suppurating wound is due to the fact that, constantly in a wound of this character, the protective barrier, formed by granulation tissue, leucocytes and exudate which are present, is broken down and is interrupted in various places by the more or less rapidly advancing necrosis and liquefaction. Depending upon the rapidity of this liquefaction necrosis and the virulence of the infecting bacteria are the extent and severity of the systemic symptoms which result from the absorption of poison produced in the suppurating area. These poisons, when absorbed, give rise to toxæmia.

If, in the advancing process associated with the development of the wound, there is a further breaking down of the protective barriers, so that the tissue spaces become open, and there is lymphatic and circulatory migration of the bacteria into the lymphatics and the small capillary radicles of the venous system, there then results not only a most marked and severe toxæmia, but a further change in which the infecting bacteria are present in the blood, the condition termed septicæmia. If the bacteria localize in some area foreign to the wound and at some distance from it, they may cause abscesses (metastatic).

The treatment of an open suppurating wound therefore resolves itself into the treatment of the four most active phases. First, the treatment localized to the wound itself; second, the treatment aimed to counteract the toxic effect of bacterial protein absorption; third, the treatment which is directed against bacteria which are circulating freely in the blood, and fourth, treatment of the mesenteric abscesses. While it is not the inten-

tion to consider the treatment of non-infected wounds, yet it may be well to briefly discuss the prevention of infection, *i.e.*, the prophylaxis of wounds already harboring pathogenetic bacteria but as yet showing no signs of infection. In all contused, lacerated, or incised wounds in which infected material is implanted, at the time of their infliction, a certain interval elapses before the infection manifests itself. This varies from eight to twenty-four hours. During this time, if all dirt and foreign material is carefully removed, all devitalized tissue dissected away, and the wound is carefully aseptized, before and after the cleansing, by soaking it in a $3\frac{1}{2}$ per cent. solution of iodine in 50 per cent. alcohol, it may be closed by immediate suture and primary union frequently occur. In badly lacerated scalp wounds and in comminuted fractures of the skull, the entire devitalized area, including the destroyed bone, should be removed by section through healthy surrounding tissues. Should, in this cleansing process, a large area of brain cortex be exposed, it is covered, either by a sliding or a pedunculated flap, whichever the mechanics of the case demand. This method, primary prophylactic cleansing and excision, requires that in every case a sufficient area (at least 1 cm. from the edge of the wound) be resected, so incision may remain beyond any colonies of bacteria which may have been forced into the surrounding tissues, at the time infliction of the wound may have infiltrated in these tissues during the interval between infliction and treatment.

Should the prophylactic tissue resection and treatment have failed, or should the wound be already infected at the first examination, it should then be treated as an infected open wound.

This treatment, as has previously been said, is directed first to the treatment of the wound itself, which may be regarded as the local treatment. Second, the treatment of the toxæmia, of the septicæmia and of the pyæmia. These all may be grouped under general treatment and will be so considered.

The local treatment is carried out through the following processes: I. Cleansing the wound. II. Rendering the wound sterile. III. Supporting the wound by (a) rest, (b) increasing the local resistance, (c) increasing the activity of the leucocytes in the granulation tissue wall. IV. Closing the wound by (a) direct suture, (b) by granulation, or (c) by graft.

I. In cleansing the wound all devitalized and necrotic tissue should be excised. The wound should be thoroughly irrigated with a hot antiseptic solution, such as iodine $\frac{1}{2}$ per cent. or any other suitable antiseptic solution. Violence should not be used, gentleness is most essential. It is better to remove adherent tissue with a knife or scissors than to pull, tear, or gouge it away. After the wound has been cleansed, it should be covered with dry dressings. Should it remain infected, it must be rendered sterile.

II. Sterilization of the wound may be brought about by a combination

TREATMENT OF AN OPEN INFECTED WOUND

of the following: (a) The direct destruction of the bacteria by the application of antiseptic solutions to the wound. (b) The lowering of the bacterial resistance, either by the reduction of the suitable nutritive media for the bacteria, or the application of cold to the infected area. (c) By engrafting on the wound a growth of bacteria which, while harmless to the host are inimical to the invading pathogenic bacteria.

Bacterial destruction is also hastened by

III. Supporting the wound by (a) local rest, if the wound is on a movable tissue, splints, casts, or supporting bandages are applied, so as to make the part immobile; (b) rendering the local tissue cells more resistant to the bacterial toxins, and at the same time (c) stimulating leucocytic activity in the protective granulation wall erected around the infected area, synchronously increasing in thickness the granulation wall; (d) local segregation of toxins should also be attempted; (e) reversal of the lymph flow (so that the wound weeps fluid) may also be promoted, either when the infecting organisms are of a low or after a leucocytic wall has formed, or in combination with antiseptics in cases of very severe and dangerous infections. In fact, in such infections this type of exosmosis might be tried in combination with a very strong antiseptic. The reversal of the lymph flow may be induced by Bier's hyperæmia bandage, by suction, and by the continuous application to the infected area of hypertonic solutions of different salts.

Schiassi has long been emphasizing the advantage of treating war wounds by inducing an intense flow of fluids outward, by exosmosis from the depths of the wound. He defines the process as an "exhumoral expulsive cellular antiseptis" supplemented by an intense plasmatic and histologic defense and regeneration. The solution he uses for this purpose is a mixture of 8 gm. sodium chloride, 1.5 gm. glucose, and 1000 c.c. water. For stronger action he adds to the above 2 gm. sodium citrate and 0.5 gm. sodium hydrate.

This fluid disintegrates dead tissues and draws fluid out of the tissues as if by suction. This exosmosis is further promoted by keeping the part in a hot bath for hours at a time.

In this same relation Sir Almroth Wright (*Lancet*, 1917, I, 930) recommends a hypertonic solution of salt as a means of breaking down the leucocytes. This liberates tripsin which rapidly digests the dead tissue from the living. To carry off the infection a reinforced solution (salt solution normal, and 25 per cent. zinc sulphate) is used. The removal of the discharges is, according to Wright, a very important procedure, and according to him is the especial merit of the Carrel-Dakin treatment. All the antiseptics of the chlorine group are active lymphogogues. This lymph discharge decreases as the granulation tissue increases.

IV. After the wound has been rendered sterile, it is closed, either by direct suture or by granulation. The sterility of the wound is determined by direct microscopical examination of the discharge taken from different

areas of the suppurating surface. Ordinary platinum loops are used to smear the discharge from the suppurating surface on the slide (microscopic). When not more than one organism per five fields is present the wound may be closed by direct suture.

During this time the local treatment should not absorb our entire attention, but we should consider carefully the general condition of the patient and institute appropriate measures for his support and relief. These measures will be discussed after the local treatment has been covered.

Local Treatment of an Open Wound.—Since we have already described the method of wound cleansing, we shall now discuss the sterilization of the infected focus by the direct destruction of bacteria with antiseptic media.

Bacteria, because of their capsule formation, are greatly resistant to antiseptic media. This capsule is the result of the accommodation of the bacteria to the animal body. It is most marked in the bacteria resident in the predilection places for chronic inflammation, such as the lungs and middle ear (Sauerbeck). The ideal disinfectant is one which destroys the bacteria, but does not destroy the animal cells, and the ultra-ideal would be a disinfectant which has a specific and selective action on the bacteria which are the cause of the infection. As yet, principally because of the resistant bacterial capsule formation, no such antiseptic has been found.

The rapidity with which a wound heals depends to a considerable degree upon the activity of the leucocytes. They destroy the bacteria and remove the debris, both dead bacteria and disintegrated tissue cells. Most disinfectants have a deleterious action on the leucocytes and hinder their mobility and phagocytosis. However, there are some antiseptics, as mercury and the hypochlorites, according to Dakin, quoting from Perry Morgan, which have little effect on phagocytosis. Activity of leucocytes obtained from wounds recently treated with hypochlorites was regularly noted. Nevertheless, as Dakin and Dunham observe, the death of a certain number of cells is of relatively slight importance if the offensive organisms are at the same time materially diminished in numbers or in offensive capacity.

Yet it should be remembered when formulating antiseptic media that such media must be as slightly injurious as is possible to the tissue-cells, while at the same time they should exert the ultimate degree of destruction against the invading bacteria. In this respect it is well to recall the point which Ross brings forth; namely, that the "cell cannot control the diffusion of substance into itself, nor can it choose from its surroundings any one substance and leave another." Therefore, antiseptic substances which are destructive to animal cells should be used with great caution.

III. Measures for Supporting the Wound.—These are to be classified as (a) local rest, (b) rendering the local tissue-cells more resistant to bacterial toxins, (c) increasing the number and stimulating the activity of the leucocytes in the protective granulation tissue wall erected around

TREATMENT OF AN OPEN INFECTED WOUND

the infected area, and at the same time increasing in thickness of this granulation wall with (*d*) local segregation of toxins and (*e*) reversal of the lymph flow. *A, d, e* have been discussed. (*b*) The rendering of the local cells more resistant to bacterial toxins has as yet but an academic interest. It might seem possible that the injection of autogenous vaccines circumferentially around the infected area, not too far from the edge of the wound, may have an influence in stimulating the resistance of the cells in the infected area provided the vaccines could come into contact with the involved cells; and then if a reversal of the lymph flow with hyperæmia of the part be induced, it is an interesting hypothesis to suppose that the local cells will develop an increased resisting, perhaps destructive power, against the pathogenic invading organisms. Simultaneous with (*b*) an effort should be made to stimulate the regenerative forces and excite the reactive processes necessary for the healing of the wound. These are included under (*c*) (see above).

The increasing of the number of leucocytes in the leucocytic wall and at the same time the stimulating of the amœboid activity of those which are present in the wall may be brought about by local measures, such as heat, hyperæmia (passive) and stimulants, such as balsam. These also increase amœboid activity and growth. The leucocytes in the circulating blood may be increased by giving internally certain stimulants, such as nucleins or nucleates. Diathermie may be of some value, as an aid to increase leucocytic activity and tissue reaction. Atropine will also cause an increase in leucocytic movements (Ross).

Local measures aiming to increase the granulation tissue wall and stimulate cellular reproduction include the use of auxetics. Ross, of Liverpool, was one of the first to recognize the rôle of certain substances stimulating cellular reproduction. These substances when they come into contact with living cells cause cellular growth and reproduction in these cells. In his studies of cancer-cell growth Ross found that broken-down cells and certain derivatives of coal tar caused a marked cellular proliferation. After considerable experimentation he devised compounds which have as their basic action the stimulation of cellular proliferation. The stimulating substances he termed auxetics. Some of them are atropine, quinine, cadaverine and theobromine. For practical purposes he devised both a solution for swabbing and a paste for application. The solution for swabbing consists of sod. chloride, 0.9; sod. cit., 1.0; theobromine, 1 (to saturation); water, 100.0. The paste for application is composed of sod. chloride, 0.9; sod. cit., 1.0; tyrosin or theobromine, 1.0; sod. carb., 1.0; water, 100.0. Cadaverine (pentamethelene diamine) increases the action of the auxetics about five-fold. It is what Ross calls an augmentor.

The increase of the thickness of the granulation wall is induced by (1) the removal of all positive pressure in the suppurating cavity and simultaneously maintaining communication with the external surface.

This causes an increase in size and thickness of the granulations, because granulations are the result of the positive pressure inside the vessels forcing up towards the surface small branches of these vessels. Some claim that the new vessels are formed from the endothelial cells of the smallest vessels, while it is claimed by others that they are formed by the fibroblasts. Therefore, any process which would force with extraordinary rapidity the terminal capillary tufts up onto the surface increases the healing. (2) Granulation tissue is also increased by heat, applied by means of the hot-air cabinet, hot packs, thermophore, sun rays (direct exposure to the sun). These have a positive stimulating action on the granulating surface. (3) Light is wonderfully efficacious in slow healing. It stimulates granulations. The violet rays are very superficial in their action. The X-ray will kill bacteria. Incandescent light probably depends upon its activity in stimulating granulating surfaces upon the hyperæmia which it induces. An accessory essential to the above measures is rest. The rest should be both mental and physical, local and general. In severe infections the patient should rest quietly in bed. If he is restless a sedative should be given. All worry and mental strain should be relieved as much as possible, and sleep should be induced. The inflamed part should be immobilized by splints, casts or supports. Adequate drainage to properly carry away the discharge should be provided. Dressings must be changed as frequently as they are soiled, but the wound should be handled as little as possible. After the suitable local measures have been provided, general measures aiming to increase the general health of the patient are instituted. These will be fully discussed under general treatment.

IV. After the wound has become sterile and is granulating a decision should be reached as to whether it should be allowed to heal by granulations or whether it should be sutured or whether grafts should be used. All superficial granulating wounds heal quicker if pin-point grafts are transferred to their surface. Over the grafts as a protection is placed a perforated, paraffinized, meshed dressing. This is not removed for some days. The wound is freely exposed to the air and to a moderate degree of sunlight. If the wound is a deep one, it is not suited for grafting and the tissues should be brought together by sutures, and the skin should also be closed by suture; various methods of flap formation being used to cover in the denuded surface. If it is impossible to cover in the surface by any method of flap formation, it is necessary to allow the wound to heal by granulation, and at the proper time to apply skin grafts. A further discussion of the healing factors active in wound healing by granulation will be discussed under the recovery stage.

General Treatment.—If during the treatment of an infected area symptoms of toxæmia or sepsis arise, measures should be taken at once to combat or neutralize the poisoning. These measures are: I. The introduction of large quantities of fluid into the system. This fluid may be

TREATMENT OF AN OPEN INFECTED WOUND

given by mouth, if the patient is conscious and there are no other contraindications, or by enteroclysis, hypodermoclysis, or intravenous in states of great urgency or where a sure and certain result is sought. The most efficacious fluid to introduce into the system as a means of combating infection is, as far as is known at the present time, a combination of sodium carbonate or bicarbonate and glucose.

Sodium carbonate is used in enteroclysis and intravenously, but not in hypodermoclysis, because of its great tendency to produce necrosis of the tissues and sloughing.

Glucose in the blood acts by being first converted into glycuronic acid which unites with organic and inorganic bases circulating in the blood. For instance, skatol and indol are first oxidized and then unite to the glycuronic acid. Sulphuric acid acts in a similar manner. For instance, indol is changed into indoxyl and this in turn into indican.

The oxygen for the above changes is readily furnished from the carbonate which is given with the glucose. Because of the great combining power of the sulphate I am in the habit of strengthening or increasing the action of the glucose and alkali by adding KHSO_4 to the enteroclysis in the proportion of 1 to 500.

It has also been claimed that glucose (Wells) acts as an antigen. This action is greatly increased by the presence of an alkali. This is probably the chief action of the alkali carbonate, when it is combined with glucose in the combating of severe infections. Another reason for using alkalies is that increase of the alkalinity of the blood will increase its bactericidal power (Wells, p. 228).

II. If the infection is very severe and the patient's resistance is being overcome, the most certain and effective means at our command of giving support, until the critical moment has passed, is blood transfusion. I have seen patients, who were otherwise doomed, recover sufficiently by this means to enable them to carry on and develop a resistance to the infecting organisms. Improvement was practically immediate and the recovery stage markedly shortened. The donor should be carefully selected by the method of grouping as advocated by Moss. An attempt may, if time permits, be made to render the donor's blood antitoxic to the infecting organism by injecting into the donor vaccines made from appropriate infecting bacteria, derived from the recipient. In doing this care should be exercised that the donor's blood is not removed in the negative reactive phase; otherwise harm to the recipient will result. Blood transfusion is of value in any stage of sepsis, but especially in the early periods of the fulminating type, when the patient is rapidly losing his resistance and the recovery is problematical.

Further methods of combating the infection and resulting toxæmia are:

III. The introduction into the system, if at all possible, of an antitoxin to the causative bacteria. This is now possible in a few instances, as in epidemic cerebrospinal meningitis, tetanus. In pneumococcic menin-

gitis antipneumococcic serum is active in about 30 per cent. of the cases. Streptococcic meningitis is practically always fatal. To my knowledge no case has ever recovered.

The methods of using or applying the antitoxin are: (1) Local application. (This has been recommended by McGlannan.) (2) Injection into the infected area or the adjacent tissues. (3) Injection into special tissues. (Nerve tissue, as in tetanus.) (4) Injection into the circulation. (5) Injection into the cerebrospinal canal. (Tetanus.) In addition, it is also necessary:

IV. To support the patient until the antitoxin acts, or if no antitoxin is available, until the body has had time to marshal her forces and has produced her own antitoxin. The principal means of doing this are:

1. By increasing the nourishment of the body, with consequent increase in the local resistance.

2. By stimulation of antitoxin formation. If the body reactive forces are sluggish, the injection of vaccines will sometimes incite the antitoxin-producing apparatus to full activity. In operative cases, where infection is feared, an injection of a mixed vaccine prior to, and one immediately after operation, may save a life which otherwise would be sacrificed to the moloch of careless antisepsis.

3. Keeping up the fluids of the body is most important. They are maintained by:

(a) Enteroclysis of sodium carbonate 5 per cent. and glucose 5 per cent.

(b) Hypodermoclysis of sodium bicarbonate 2 per cent. and glucose 2 per cent. or 5 per cent., or of salt solution.

(c) Intravenous injection of sodium carbonate 2 per cent. and glucose 2 per cent. or 5 per cent.

4. By maintaining the blood-pressure. In severe cases of infection the blood-pressure drops; the systolic not so far, but the diastolic drop is very marked. If the diastolic drops below 60 the case is becoming serious, and if the drop is below 50 the case is most serious. Porter claims that a patient whose diastolic blood-pressure remains at 45 or 50 for some time will not recover without external aid. When the pressure drops to 50 the blood accumulates in the abdominal veins and a further reduction of pressure with lessened probability of recovery occurs.

The treatment for this condition as instituted consists of:

A. Gravitation. The feet of the patient are kept 30 cm. higher than the head. The pillow must not be more than 6 cm. high. This position is retained until the diastolic pressure returns to and remains at normal.

B. If the patient's condition is grave, other means may be employed, *i.e.*,

(a) Saline transfusion, if the pressure is below 80 mm. When the pressure reaches 80 mm. the transfusion

TREATMENT OF AN OPEN INFECTED WOUND

should be stopped. Five hundred c.c. should be used and ten minutes taken for the injection. If the first transfusion does not bring the blood-pressure up to 80 mm. a second transfusion may be used.

- (b) If after the saline transfusion there is a tendency for the blood-pressure to drop, adrenalin should be used.
- (c) Should hemorrhages be present, the saline would have a tendency to increase them. In such cases Porter recommends the transfusion of blood.
- (d) In cases of superficial reduction in temperature heat should be used. In all cases the diastolic pressure should be read every half hour, and an operation should not be undertaken if the pressure remains below 80 mm. Should operation be undertaken, death is almost certain to result.
- (e) To eliminate the toxic products, such drugs as digitalis, caffeine, acetates, etc., should be exhibited.
- (f) General stimulation should be used and the patient should be exposed to the sun's rays or to electric light baths.

In infection the question frequently arises, how are we to determine whether the organism is overcoming infection, or vice versa—whether the infection is overcoming the organism? The best indicator at our command is the behavior of the white blood-cells. It seems that the percentage of the increase of the polymorphonuclear is an indicator of the severity of the infection, while the relative increase of the polymorphonuclear to the total white is an indicator of the resistance of the organism (Sondern, etc.). The increase of the polymorphonuclear, without a relative increase in the leucocytes, indicates that the organism has not the required resistance and is being overcome, and two proceedings are indicated:

1. Surgical interference, in order to remove the toxic factors, and
2. Improvement of the resisting powers of the organism.

Number one should be considered under special technic. For number two several means are at hand. At the risk of too frequent repetition, it should be emphasized that among the best are those calculated to directly antagonize the toxins of the implanted bacteria. Among these are the different antitoxins and direct antiseptics, as salvarsan, bichloride, etc. (intravenous).

The acidosis may best be counteracted by alkalies as the sodium carbonates or bicarbonates in combination with glucose. Or the resisting power of the organism may be directly stimulated by the direct injection of nucleins, nucleic acid, etc.

The fifth stage of an open infected wound, that is, healing by granulation, is the

V. *Recovery Stage*.—At this time, if healing is progressive, there is:

1. An increase in granulations which may be stimulated by:
 - (a) Heat. It is very essential to the rapid healing of a part that the proper degree of heat be supplied.
 - (b) Moisture. This most essential detail of wound treatment is frequently overlooked. In old sluggish wounds moisture in the form of wet boric acid compress is very beneficial.
 - (c) Auxetics, as kreatin, xanthin, which produce an increased cell proliferation; Ross's paste which consists of salts, theobromine, etc.
 - (d) Irritants, as silver nitrate, balsam, and light rubbing with gauze. This method of interference should not be used if the healing process is proceeding normally, and should be used only if healing is sluggish or greatly retarded.
2. An increased antitoxin formation. This is stimulated by vaccines, as diphtheria, tetanus.
3. An increased resisting power of tissues which is stimulated by:
 - (a) Nourishment, such as: (1) Food. (2) Transfusion, which brings to the diseased area fresh blood-cells and antigen.
 - (b) Rest.
 - (c) Vaccines of the particular type causing the infection.
 - (d) Protection to the part, so that excessive motion, pressure or irritation does not occur.

The granulating surface may be protected by various substances. The latest and best is the paraffin wax of L'Ambri. This is very useful in the treatment of burns. However, the granulating surface must be clean (absence of pus) and dry before the wax is applied.

In this recovery stage the body forces may either be exhausted or else may be equalized by the toxic products of the infected area and healing becomes stationary. This loss of activity is indicated by an excess of necrotic tissue. This necrotic tissue may be removed and healthy granulations exposed by digestion with combination of pepsin, pancreatin, etc., with an antiseptic. It may also be removed by rubbing with gauze or a dull curette.

If the infectious process is too powerful, it may overcome the resisting barrier which the body has erected to its progress, and instead of being progressive the healing is retrogressive and may result in generalized blood involvement, causing septicæmia and pyæmia. If this occurs, the action of the bacteria circulating in the blood may be combated by (a) antitoxins of the same type of bacteria, or (b) antiseptics introduced intravenously, as bichloride as much as $\frac{2}{3}$ gr. in 50 c.c. of distilled or salvarsan water, or quinine as high as 20 gr. or in the form of urea and

TREATMENT OF AN OPEN INFECTED WOUND

quinine hydrochloride gr. $7\frac{1}{2}$ every third hour, given intramuscular; salvarsan may also be used.

A progressive infection may also cause an increasing acidosis which may be combated by the injection of Na_2CO_3 or NaOH or saline, or by the introduction of oxidizing substances, such as glucose. These injections may be by bowel, by hypodermoclysis (be careful not to use sodium carbonate), or by intravenous.

At this time, when the patient's general resistance is reduced, an increase of the generalized resistance may be brought about by the injection of carbohydrates, sugars, etc., and by nourishing and easily digested food. In all septic states plenty of fluid should be given to increase urinary elimination. Stopping of diarrhoeas must be accomplished by morphine or opium, charcoal, bismuth, etc. Quiet and absolute rest should be induced by morphine.

RECURRENT UNILATERAL SUBLUXATION OF THE MANDIBLE, EXCISION OF THE INTERARTICULAR CARTILAGE

IN CASES OF SNAPPING JAW*

By ASTLEY P. C. ASHHURST, M.D.

OF PHILADELPHIA, PA.

ILLUSTRATIVE CASE.—Frances G., aged sixteen years, was admitted April 16, 1920, to the Orthopædic Hospital, and referred to my care by Dr. F. W. Sinkler. *Previous history* was negative, except that she had had several teeth pulled, though without taking any anæsthetic, so it is probable no undue force had been employed.

Her *present condition* dated back for about two years; during this time unilateral (right-sided) subluxation of the jaw had occurred on an average of once a month, and for the last three or four months more frequently. It occurred at first only when eating: there would be severe pain in front of the right ear, the mouth would be locked open, and she would have to stop her meal at once. For a long time she could reduce the displacement herself without calling a physician, but one morning in January, 1920, the dislocation occurred at breakfast, and she had to call a physician because it was found that even with her chin bandaged the dislocation recurred, and even if she did not try to open her mouth. Subsequent to this date, though, a bandage was worn, the dislocation frequently occurred during sleep, and she would be awakened by the attendant pain. In one day she had to have five different doctors called in emergency to reduce the recurring dislocations; one time only, about a week before admission, was it necessary for the physician to administer an anæsthetic (chloroform) to reduce the dislocation.

By this time the frequent recurrence of the dislocation, and its occurrence with slight or no provocation, induced a hysterical state of high degree, and it was for this that she came under Doctor Sinkler's care.

On admission she wore a bandage holding her mouth shut, and she resolutely refused to attempt to open her mouth for fear of inducing the dislocation. This bandage had been worn constantly for weeks, and she was extremely hysterical, dishevelled, and miserable. For weeks she had taken only liquid food. If her teeth were separated even 0.5 cm. the dislocation would occur, with marked pain, and required manipulation for its reduction; dislocation occurred a number of times while she was in the hospital before operation.

X-ray examination by Dr. R. S. Bromer showed that when luxation was present the mandible on the affected side (right) rode for-

* Read before the Philadelphia Academy of Surgery, Feb. 7, 1921.

SNAPPING JAW

ward on the maxilla, as determined by the relative position of the molar teeth on the upper and lower jaws; but no abnormality in the joint could be detected.

The cause of the recurring subluxation of the jaw was a matter of some interest. The affection was first accurately described by Sir Astley Cooper (1822), and according to Malgaigne (*Traité des Fractures et des Luxations*, Paris, 1855, ii, 295), no one previously, except J. L. Petit, had recognized the possibility of anything less than a complete dislocation. The following is Cooper's description:

"*Subluxation of the Jaw.*"—"As in the knee the thigh-bone is sometimes thrown from its semilunar cartilages, so the jaw appears to occasionally quit the inarticular cartilage of the temporal cavity, slipping before its edge, and locking the jaw with the mouth slightly opened. It generally happens that this state is quickly removed by natural efforts alone; but I have seen it continue for a length of time, and the motion of the jaw, and power of closing the mouth, have still returned. This state of the jaw happens from extreme degrees of relaxation. The patient finds herself [note the sex] suddenly incapable of entirely closing the mouth. Some pain is felt, and the mouth is least closed on the side on which the pain is felt.

"Force for removing these appearances must be applied directly downwards, so as to separate the jaw from the temporal bone and to give an opportunity for the cartilage to replace itself upon the rounded extremity of the condyloid process.

"In extreme degrees of relaxation, a *snapping* is felt in the maxillary articulation just before the ear with some pain arising from the jaw suddenly slipping into its socket, which the relaxation of the ligament had permitted it to quit and to advance upon the zygomatic tubercle.

"Young women are most the subjects of this sensation, and the means which I have found most frequently and quickly ensure their recovery, have been ammonia and steel as medicine; with the shower-bath, and the application of a blister before the ear when the complaint has continued for a length of time."—"A Treatise on Dislocations and on Fractures of the Joints."

Cooper, it is seen, believed the lesion consisted in displacement of the cartilage from the condyle, the latter riding forward and leaving the cartilage in the glenoid cavity; whereas normally the cartilage is firmly attached to the condyle, and with it moves forward upon the eminentia articularis when the mouth is widely opened. And this seems the most reasonable explanation, inasmuch as a forward displacement of the cartilage upon the condyle could scarcely prevent closure of the mouth, though it might interfere with opening it.

In mild degrees the affection may be termed "snapping" or "clacking" jaw, a noise (audible to the patient and sometimes to bystanders) being made by mastication by the cartilage slipping around inside the joint. My own right temporo-mandibular joint is so affected, the clacking being most easily produced (painlessly) by lateral motions of the mandible. This is in accord with the facts pointed out by Pringle (*Brit. J. Surg.*, 1919, VI, 385, January), that whereas, motion between the cartilage and the temporal bone occurs in the sagittal plane in the movements of opening and shutting the mouth, yet the only motion between

the cartilage and the condyle is one of rotation. As the external pterygoid muscle is attached to the anterior end of the cartilage, Pringle believes that the disability is due to sudden violent action of this muscle displacing the cartilage forward and inward. Thus the thick central ridge of the cartilage (Fig. 1) he believes becomes placed obliquely, instead of lying in the coronal plane. He says he believes it is impossible for the disk to become displaced from the condyle, as it is so closely applied; but he noted in operating on one patient that the cartilage could be dragged freely over the condyle in whatever position the mandible was placed. He suffers from this recurrent subluxation of the jaw himself, and has encountered four patients (two medical students and two young women) with the same affection in a more or less aggravated degree. In the two women patients the affection developed gradually after the extraction of some teeth under anaesthesia. His mechanism for reducing the luxation when it occurs consists in keeping up hard pressure at the back of the condyle with the mouth open, and then slowly closing the jaw.

Whatever the exact cause of the dislocation, it is evident that the cartilage is at fault, and that the simplest and most certain cure must consist in the removal of the cartilage. Annondale (*Lancet*, 1887, I, 411), it is true, secured relief in two cases by suturing the cartilage to the condyle; but the analogous operation for subluxation of the semilunar cartilage in the knee has long since been abandoned, experience having shown that more certain as well as more lasting relief is secured by its excision. J. B. Blake (*Trans. Am. Surg. Assoc.*, 1918, xxxvi, 350) dwelt with undue emphasis, I believe, on the difficulty and danger of any operation on the temporo-mandibular joint itself, and certainly his theoretical objections to removal of the cartilage are not well founded. It is the obnoxious structure, and its removal, far from increasing the disability, brings relief. It is the same as with a loose cartilage in any other joint: when the cartilage becomes displaced sufficiently far, the joint locks. The operation adopted by Blake himself (suture of the coronoid process to the zygoma), while eventually successful in his patient, evidently was attended by no such prompt relief as in the present instance; and since a separation of the teeth even of 0.5 cm. in this girl was attended by luxation, it would have been manifestly impracticable to adopt Blake's plan in her case. Pringle secured complete relief in one patient by excision of the cartilage, and believes his operation is the only one of its kind on record.



FIG. 1.—Showing intra-articular cartilage in temporo-mandibular joint. The cartilage has been sectioned in the sagittal plane. Note its thickness in above condyle, and thinness anteriorly; also attachment of external pterygoid muscle.

SNAPPING JAW

Accordingly, after this girl's highly hysterical state had been somewhat subdued by hospital regimen under Doctor Sinkler's care, operation was undertaken May 1, 1920.

Under ether anæsthesia an incision was made over the zygoma, 2 cm. in length, backward to the auricle, thence downward for 3 cm. in front of the auricle. The masseter muscle was detached subperiosteally and the small triangular flap of skin and muscle turned down. The cartilage was easily identified, moving with the condyle of the mandible, but very loosely attached. It was caught in a sharp tenaculum, and excised with scissors. Bleeding was controlled by a temporary gauze pack. The incision was closed in layers, without drainage.

Convalescence was uneventful. On May 7th it was noted that she could open her mouth far enough to protrude her tongue easily, without luxation occurring, and she was allowed to eat vegetables. May 11th she was able to open her mouth 2.5 cm. easily; no luxation had occurred since the operation, and the girl's hysterics were gone.

Seen again in November, 1920. There has been no further trouble with the jaw, and the scar of operation can scarcely be seen even on close inspection. The mouth can be opened to full normal width, and normal power in mastication is present. The girl has had several more teeth pulled, and has been under nearly constant treatment, her mother informs me, by osteopaths, for a "lameness" and "pressure on the nerves of the spinal cord"; symptoms which are evidently hysterical in origin.

TREATMENT OF CARCINOMA OF THE TONGUE

By DOUGLAS QUICK, M.D.

OF NEW YORK, N.Y.

ATTENDING SURGEON TO THE MEMORIAL HOSPITAL

CARCINOMA of the tongue has proved itself to be one of the most difficult types of malignant disease with which to deal. The microscopic anatomy is rather uniform, but the clinical course varies extensively. On the whole, it may be said that growth is rapid and dissemination early. This is probably due to the rich vascular and lymphatic supply and to the constant movement of the organ. While it is relatively accessible, it is, nevertheless, much more fatal than many other more inaccessible types of cancer. It terminates fatally in 75 to 90 per cent. of cases, according to Warren, Butlin and Meller.¹ In frequency, Jessett¹ places it second only to carcinoma of the cervix, while Jacobsen¹ gives it third place. The average duration of life in untreated cases is less than two years.

In the treatment of this disease surgery alone has proved inadequate and unsatisfactory for various reasons. Many cases come to the surgeon in the inoperable stage, thereby leaving a large group in which surgery offers nothing; in fact, offers worse than nothing if an ill-advised operation is attempted. In our own series of cases only 27 per cent. were operable at the time of applying for treatment. This figure is, of course, too low as an average, because, especially in our earlier work, we received none but very advanced cases. It is encouraging to note, however, that more recently we are getting much earlier cases for treatment.

The location of the lesion on the tongue has a great deal to do with determining its operability. Bastianelli² has noted that those on the tip of the tongue are most favorable for operation, while of those at the base he has not seen a single cure and advises against operation if the growth be in this location.

We frequently see the primary lesion operable but the lymph-nodes inoperable. In a considerable percentage of cases, operable as far as the extent of the disease is concerned, the general condition of the patient is not sufficiently good to withstand the surgical shock. Many of these patients are suitable subjects for pneumonia or some other intercurrent infection following the radical surgical procedure. In view of these considerations, we see at once that surgery occupies a limited field in the treatment of the disease as a whole.

Within the operable field, surgical statistics vary to a considerable extent. Meller¹ found that operation prolonged life thirteen and four-tenths months, cured 14.6 per cent., and had a mortality of 13 per cent. Morestein³ placed the operative mortality at 20 to 25 per cent., Capetti⁴ at 11.6 per cent., and

TREATMENT OF CARCINOMA OF THE TONGUE

Poirier⁵ 25 per cent. In his series of collected cases, Bastianelli² found 11.6 per cent. well over three years. Butlin,⁶ in a review of 197 cases, found fifty-five, or 27.8 per cent., well from three to twenty-three years. Of those dead a much larger percentage were from recurrences in the nodes than from recurrence of the local lesion. He had no cases well following operation on recurrences.

In an analysis of 777 cases, Capetti⁴ found 18 per cent. free from disease over three years, and from a group of selected operators noted that this proportion was raised to 20 per cent. Caird,⁷ in an analysis of sixty hospital cases, found, at the time of his report, sixteen survivors. Of these, ten cases were well one year, and one each twenty, twenty-four, thirty, thirty-one months, seven years and eight years.

In a report of thirty cases from the Boston City Hospital, Lathrop and Scannell⁸ had two cases alive seven and five years, respectively, both from partial excisions. Of those dead, the longest period of life after operation was two years.

Cobb and Simmons,⁹ of the Massachusetts General Hospital, reported fifty-six cases of carcinoma of the tongue, thirty-four of which were operated upon. The types of operation ranged from the simplest to the most radical. The immediate operative mortality was 8.5 per cent., and of the thirty-four cases, four were alive and well at the time of the report, two cases thirteen years, one case six years, one four years, and another died of some intercurrent disease at the end of four and one-half years. Including this last case, their cures were 14.3 per cent. They have noted, also, that all of these clinical cures occurred in elderly patients.

In view of these collected surgical statistics it is quite evident that much remains to be hoped for in the treatment of cancer of the tongue.

In our own work we have divided the treatment of this disease into two distinct parts.

PART I.—TREATMENT OF THE PRIMARY LESION

In the treatment of the primary lesion we feel very strongly that surgery occupies no place, and that this part of the disease belongs entirely to the radium field.

In our earlier work with surface applications of radium we were, on the whole, disappointed; so much so that in the 1915 and 1916 report from the Memorial Hospital Doctor Janeway stated that "by the time carcinoma of the tongue becomes over one centimetre in diameter, the possibility of healing it with radium becomes uncertain."

Based on the knowledge at hand at that time, I believe his conclusion was correct as far as the use of radium on the surface is concerned. Only one of the four cases reported clinically free from disease in that report still remains well.

Shortly after that period we began burying radium emanation in the substance of the growth, and by this change in technic we feel that our results

have been immeasurably improved. In view of this alteration in technic the present report is made to cover a period of only a little over three years.

While we have not discarded surface applications of radium in tongue cancer, we feel that its use in this way is confined to the treatment of certain very superficial growths such as some of those beginning in leucoplakic areas, to the cases of basal-cell carcinoma which we very occasionally meet with in the tongue, and to supplementing doses of buried emanation. The bulk of our treatment rests entirely upon the use of buried emanation. For this purpose we use fine glass capillary tubes about three millimetres in length and 0.3 millimetre in diameter, each containing about one millicurie of radium emanation. I specify one millicurie, or slightly less, as being the most satisfactory strength to use at present. In our earlier work we used tubes of two, three, and four millicuries, but found that they produced too much necrosis of tissue.

Radium emanation decays at the rate of about 15 per cent. per day, so that the total value of one millicurie is equivalent to approximately 132 mc. hrs. of continuous radiation.

These weak tubes are buried uniformly throughout the growth by means of fine trocar needles and left *in situ*. In order to make this as painless as possible, the lingual nerve is injected with 1 per cent. novocaine, or, if the lesion be far back on the tongue, infiltration with novocaine is used. The dose of radium applied in this way depends, of course, upon the size of the lesion, although the average is probably from six to fifteen millicuries. The shape of the lesion also has something to do with the amount necessary, since it is quite evident that a bulky, spherical lesion requires relatively less than one of the elongated type extending for a considerable distance along the lateral border of the tongue.

Uniformity of distribution and accuracy of approximation throughout the growth are the all-important factors, and, in case the fixed number of tubes determined upon is insufficient to fill these requirements, it is advisable to use more tubes of weaker individual values.

While the use of radium emanation in this manner is, in many respects, comparable to the burying of steel or gold needles containing radium element, still there are certain features of difference. By the use of emanation tubes a more intense beta ray effect is obtained throughout the entire area, since the emanation is filtered only by the thin wall of the capillary tube which removes only the alpha rays. A very prolonged radiation of both beta and gamma rays obtained by this method is, we feel, superior to the shorter exposures of, mainly, gamma rays made necessary where metal containers with larger amounts of the element are inserted in the growth and removed after a few hours.

The tissue reactions incident to this very prolonged radiation over a period of weeks are very important. The amount of trauma is less and distribution can be made much more uniform and accurate by burying the emanation tubes.

TREATMENT OF CARCINOMA OF THE TONGUE

The emanation decreases in value at the rate of approximately 15 per cent. per day, so that in about four days one-half of its energy has been spent, while at the end of eight days approximately one-fourth of its activity is still present. It will thus be seen that radiation is carried out over a prolonged period without the discomfort to the patient of having foreign bodies, subject to being dislodged, projecting into the oral cavity. By this means the dosage can be very materially increased. In this particular connection I would warn those using needles containing the salt, that they should not attempt to equal the dose for emanation in carrying out a parallel technic with their metal needles.

By this method of treatment the radium reaction is both prolonged and intense, and is by no means painless, so that during its course every encouragement must be given the patient lest he feel that he is becoming worse rather than being benefited. Scrupulous care must be directed toward cleansing the mouth. Nourishment must not be decreased, and the patient's general physical condition must be kept at as high a level as possible.

PART II.—TREATMENT OF THE CERVICAL NODES

In the treatment of the cervical nodes we have taken a very conservative position and at the present time feel more strongly convinced than ever that this has been wise. The chief criticism I feel we should make of ourselves is that perhaps we have not followed up external radiation sufficiently. More recently we have been radiating the neck externally with radium in all of our favorable cases. In those having no enlarged nodes, this measure is used with the idea of destroying minute metastatic foci as well as by stimulating the protective defenses in the lymphatics, and, in those where palpable nodes have already appeared, with the hope of rendering the disease in this location temporarily less malignant, and therefore a safer operative risk. By external radiation alone we do not feel that we have ever been able to destroy, completely, epidermoid carcinoma in the cervical nodes.

We feel that the lymphatics of the neck perform a conservative function and represent one of nature's barriers to this disease, and that unless definite involvement is noted they should not be interfered with surgically. A very considerable percentage of cases do not develop metastases in the neck at all or until late in the course of the disease. This is especially true in elderly patients. The routine block dissection as commonly practiced does not remove all of the possible avenues of dissemination. It does, however, remove one of nature's chief barriers, frequently at a time when such are needed most. Many patients are not physically able to withstand such an operation. If extension to the cervical nodes be embolic, as most of us believe, then it is quite possible that a great deal of needless surgery, with its resultant surgical shock, may be carried out and still the one small dangerous focus left unnoticed, but probably stimulated to greater activity.

In cases where no cervical nodes are palpable, our plan has been to do nothing, or confine our treatment to external radiation only, and keep the

patient under observation. If a palpable node appears, which is clinically malignant and not simply inflammatory, we then do a complete dissection of that side of the neck under local anaesthesia, removing the entire chain of nodes and burying small doses of radium emanation well distributed in weak tubes at all suspicious points in the wound, and especially at the points where the lymphatic channels are severed. By burying the emanation in this way we get a very uniform radiation throughout the entire operative field, carried over a prolonged period and without appreciable gross destruction of tissues. Healing of the wound is complete before the intensity of the radiation becomes apparent.

In our operative work I believe we are now becoming more conservative than we were at first. For example, in cases where the lymphatic mass has perforated the gland capsule of the node and is invading surrounding structures, such as the sternomastoid muscle or the great vessels, it is better to bury radium emanation uniformly throughout this mass, in the same manner as previously described, and close the wound. With the parts exposed in this way, accurate approximation of the radium can be made, and nature's barriers are left intact. The metastatic mass thus left intact affords a support for the emanation tubes such as could not be obtained in any other manner.

While we sometimes see remarkable clinical cures following the surgical removal of such masses, still, I believe that these are more or less accidental and that as a whole the results are very unsatisfactory. In certain cases also, where a single node appears late in the course of treatment, and is well confined to either the submaxillary or deep cervical groups, we are inclined to do a limited dissection of one or other group, as the case may be, burying the radium as before, after removal of the entire chain of glands in this group and leaving the other group intact. This in no way complicates the dissection of the other group at a later date if that is found necessary, and in a great number of cases in our experience, to date, it has not been necessary. Here again, a great deal depends upon the embolic theory of extension to the nodes, and I mention it as being one of the problems now under our consideration and toward which we are favorably impressed but in which we have not as yet arrived at a final decision. When the neck is exposed surgically we take advantage of the opportunity to ligate the vessels supplying the primary lesion. The lingual and facial arteries are ligated separately and in addition we always ligate the external carotid just above the superior thyroid branch. This cuts off a great deal of anastomotic circulation and, as Küster pointed out some time ago, ligation of the external carotid is no more dangerous than ligation of its branches. I do, however, favor its ligation above the superior thyroid branch, so that the nutrition of the thyroid will not be interfered with.

I should like to emphasize the doing of the neck dissection under local anaesthesia. It does away with post-anaesthetic pneumonia, hemorrhage is better controlled, more careful work can be done, and many patients may be cared for in this way who could not withstand a general anaesthetic.

TREATMENT OF CARCINOMA OF THE TONGUE

STATISTICS OF TREATED CASES

During the past three and one-half years we have treated at the Memorial Hospital 148 cases of cancer of the tongue. A large percentage of these were very far advanced and some of them, I believe, would have been better had no treatment been given. There comes a period in the course of the disease when we must recognize the fact that it is even too late for the palliative use of physical agents.

In this series of cases 134, or 90.5 per cent., were in men, and fourteen, or 9.5 per cent., in women. This, I believe, is rather a low proportion of females. Piquantin¹ found from an analysis of collected cases that 17 per cent. of cancer of the tongue appeared in women. A history of syphilis was obtainable, either in the direct clinical history or by a positive Wassermann reaction, in 35.1 per cent. of all cases. This would probably have been higher had a Wassermann reaction been done in every case. Nearly all of the men were excessive tobacco smokers, 84.5 per cent. of all cases giving a history of its use. Bad and irregular teeth were very common throughout. All of the women had a very definite history of dental irritation, excepting one, and this one had a positive Wassermann reaction and leucoplakia of the tongue.

The average duration of the disease in this series was 6.72 months, the rather high average being due probably to a few long-standing cases of one to seven years.

Of the series there were sixty-nine cases, or 45.8 per cent., primary growths without nodes, and of these only thirty-four, or 23 per cent. of the total, were classed as surgically operable. Of these thirty-four cases, twenty-nine, or 85.3 per cent., are now clinically free from disease for periods of two months to over three years from the time of beginning treatment. One died a year after treatment was begun with recurrences both locally and in the nodes. One left our service eleven months after treatment was first given, was operated upon elsewhere, and when last heard from was still free from disease. One patient was lost track of after six months. One died of diabetes one and a half years after treatment, with no clinical evidence of carcinoma present, and the fifth died eighteen months after his first treatment from extension to the neck, which he refused to have treated as we had advised.

Of these thirty-four primary operable cases without nodes, five subsequently developed cervical metastases. All were treated by the procedure previously outlined, and three are now clinically free from disease. As stated above, one died a year after treatment with both local and cervical metastases and the other was lost track of at the end of six months. Of this same group thirty, or 88.2 per cent., were verified by microscopic sections.

Of the primary cases coming to us with nodes at the time of admission, only three cases, or 2 per cent. of the total, were operable at this time. These were treated as previously outlined and all three are now clinically free from disease.

The total number of primary cases coming to us with and without nodes

at the time of admission was 128, or 86.5 per cent. of the total series. In a large number of these cases either the extent of the primary lesion or of the cervical nodes rendered the case surgically inoperable.

Of the recurrent cases applying for treatment there were twenty, or 13.5 per cent. Six of these had recurred locally only. Four recurred in the nodes only, while ten were recurrent both locally and in the nodes. Three of these cases were surgically operable. They were all local recurrences and were treated locally by burying radium emanation. Two are now clinically free from disease for periods of two and one-quarter years and one and three-quarter years, respectively, while the third has been lost track of.

Of the total series forty cases, or 27 per cent., were operable at the time of admission, and of this group there are at present thirty-four cases, or 85 per cent., clinically free from disease for periods, as previously mentioned, ranging from two months to three and one-half years.

Of the total series positive biopsies were obtained in 133 cases, or 89.8 per cent.

As to the method of treating these primary lesions, most of it has been by the burying of radium emanation tubes. One hundred and twenty-eight cases were treated by this method alone. In five cases surface applications of emanation filtered by 0.5 millimetres of silver and held in place by an applicator made of dental modelling compound was the only method of treatment. In nine cases a combination of buried emanation and surface applications was used. Two primary lesions were too advanced for any form of treatment, and four recurrent cases involved the nodes only.

External radiation to the neck, with heavily filtered radium, has been used in twenty-four cases, or 16.2 per cent. In those cases developing cervical nodes after treatment to the local lesion, the average time between the primary treatment and the gland appearance has been a little over four months, the extreme ranges being six weeks to twelve months.

Of the entire series, neck dissections as previously outlined, combined with the use of radium in the wound, have been done in fifty-eight cases, or 39 per cent. Of these there have since been recurrences in fifteen cases, or 25.8 per cent. of the operated series.

There are to date, in our total series, forty-three cases, or 29 per cent., clinically free from disease for periods ranging from three months to over three years, as follows:

Six cases clinically free from disease three to six months; seven cases clinically free from disease six to twelve months; thirteen cases clinically free from disease twelve to eighteen months; six cases clinically free from disease eighteen months to two years; seven cases clinically free from disease two to two and one-half years; four cases clinically free from disease two and one-half to three and one-half years.

In addition there are eighteen cases where radium caused a complete retrogression of the primary lesion but in whom there were hopeless neck recurrences.

TREATMENT OF CARCINOMA OF THE TONGUE

Adding these, therefore, to the previous group of cases clinically free from disease, we have sixty-one cases, or 41 per cent. of all the local lesions showing complete retrogression. There are nineteen cases, or 12.8 per cent., still improving but not as yet free from disease. Fifty-eight cases, or 39 per cent., are dead, although three of them were clinically free from carcinoma at the time of their death. One case died of diabetes, another of pneumonia, and a third of cardiorenal disease. Twenty-one cases, or 14.1 per cent., have been lost track of so that we must add them to the unfavorable group. Seven are still living but are gradually becoming worse. Twenty-one cases, or 14.1 per cent. of the entire series, were, in my opinion, unimproved by treatment. These were cases with very advanced disease, in most instances extremely advanced both locally and in the regional glands. I believe they would have been better off for the remaining short period of life left to them had no radium been used. Many advanced cases, however, were benefited for a time.

Of the group of cases clinically free from disease at the present time the average age is fifty-seven and seven-tenths years, the extreme ranges being thirty-two to seventy-eight years.

CONCLUSIONS

In our opinion the primary lesion in cancer of the tongue should be managed entirely by the use of radium. The use of buried emanation in weak tubes uniformly distributed throughout the growth is by far the method of choice in applying the radium. The cervical nodes should be treated conservatively: First, by external radiation where the neck is free from palpable involvement, and then, should metastases appear, the treatment of these should be by external radiation, followed by a complete neck dissection under local anæsthesia, coupled with the use of radium emanation in very weak tubes buried throughout the wound.

While the time factor is still too short to permit of comparison with surgical statistics, we feel convinced that this form of treatment in unselected cases will yield a higher percentage of clinical cures than will surgery alone in the selected operable group.

BIBLIOGRAPHY

- ¹ Ewing, J.: *Neoplastic Diseases*, p. 819. W. B. Saunders Co., 1919.
- ² Bastianelli, M. R.: (Rome) *Soc. Internat. Chir.* (11th Congress), 1908, i, 80.
- ³ Morestein, H.: *La Cure Radicale du Cancer de la Langue*. *Jour. Chir.*, 1919, xv, 221-252.
- ⁴ Capetti, L.: *Traitement Chirurgical du Cancer de la Langue*. Thèse (Paris), 1907.
- ⁵ Poirier, P.: *Curabilité du Cancer en Général et du Cancer de la Langue en Particulier*. *Bull. Acad. Méd.*, Paris, 1906, lxx, No. 36.
- ⁶ Butlin, H. T.: *The Results of Operations for Carcinoma of the Tongue, With an Analysis of 197 Cases*. *Brit. Med. Jour.*, 1909, i, 1-6.
- ⁷ Caird, F. M.: *Epithelioma of the Tongue—A Review of Sixty Hospital Cases*. *Edinburgh Med. Jour.*, 1911, vi, 5-16.
- ⁸ Lathrop, H. A., and Scannell, D. D.: *Results of Treatment of Cancer In and About the Mouth at Boston City Hospital*. *Boston Med. and Surg. Jour.*, 1905, clii, 421-424.
- ⁹ Cobb, Farrar, and Simmons, Channing: *Results in Cases of Carcinoma of Tonsils, Tongue and Jaws Operated On at the Massachusetts General Hospital January 1, 1892, to January 1, 1900*.

BENIGN STENOSIS OF THE ŒSOPHAGUS

WITH A REPORT OF EIGHT CASES*

By NATHAN W. GREEN, M.D.
OF NEW YORK, N.Y.

WHEN a child or an adult presents himself with the story of loss of weight coupled with difficulty in swallowing, some obstructive cause is at once suggested. Passing over the various causes, such as abscess, polyp, diverticulum and bulbar palsy, and not forgetting mediastinal tumors and aortic aneurism, one thinks of direct obstruction by stenosis; benign, malignant or spasmodic; or by a foreign body. Foreign bodies can usually be indicated or ruled out by the immediate history. The particular kind of stenosis must be detected by the more remote history, the age and character of the patient, and the symptoms. Leaving out the spasmodic and malignant stenoses with which this paper does not deal, we have the benign cases remaining. In the benign stenoses we have a class of cases usually young and in whom the outlook is hopeful. Much, one might almost say everything, can be done for them surgically, and the results are pleasant to consider.

The history of the average case dates back some months, it may be years; it may even be to birth. A little child creeping on the floor reaches out and swallows some lye or strong caustic; or by mistake an adult drinks some acid. The first effect is a burning of the mouth, throat and gullet. Frantic efforts are made to give an antidote, but before one can count ten the mucous membrane of the hollow tube is damaged beyond the reach of antidotes. Then comes a time when only soreness persists; and with soothing fluids and fluid food all seems to be going well, till one day the patient finds upon attempting it, he cannot swallow solid food. Later the thicker fluids and then even water only will pass, and that with sluggishness. For the early symptoms the patient seeks the practitioner; for the later symptoms and often sadly the much later symptoms the practitioner seeks the surgeon. By this time the stenosis is so tight the surgeon's task is rendered fourfold more difficult.

In the hands of the more fortunate the patient is placed under curative procedures earlier—before the stricture has closed and while still fluids pass easily. Scar tissue and pericœsophageal adhesions cause the mischief.

The locality of the stenosis is more frequently at the lower end of the œsophagus—the epicardia: less frequently opposite the tracheal bifurcation and least frequently opposite the cricoid cartilage. The cause of this is probably the rate of speed a swallowed mass traverses the gullet. The greater speed is at the entrance; it slows down about the middle,

* Read before the New York Surgical Society, March 9, 1921.

and pauses for a brief moment before discharging into the stomach. Lerche quotes Schreiber in support of this contention. The site of these stenoses also corresponds approximately to the natural narrowings of the oesophagus. These, according to von Hacker, as cited in Lerche's article, occur most constantly "at the level of the bifurcation of the trachea or somewhat above; at the beginning of the organ or closely below; and on a level with the hiatus oesophagus: but one or more of these may be absent."¹

It may, then, be the difference in speed coupled with the physiologic constrictions which determines the site of the strictures. After watching the rate of flow by means of the fluoroscope it seems probable that the rate of speed has most to do with causing the lesion.

Lerche says the bolus arrives at the stomach in from seven to ten seconds; Carman places it from two to ten seconds.¹¹ From my own observations, together with Doctor LeWald's, I would place the time interval at two to five seconds, varying with the consistency of the mass ingested. Undoubtedly desire and the size of the bolus may influence the speed and "the propelling force of the peristalsis may come to a momentary halt by retching and vomiting." Other things being equal, the slower the speed the deeper the burn and the worse the stricture.

The symptoms have been briefly noted earlier: here they may be repeated. The cardinal ones are dysphagia, regurgitation, emaciation, hunger, thirst, weakness and constipation: this last from lack of material taken in. Occasionally cough and apparent salivation are secondary. The cough may come from an accumulation of saliva spilling over into the larynx or from irritation of the vagus nerves from pressure lower down.

The diagnosis is confirmed by the absence of splash sound on swallowing water; by the röntgenogram; the oesophagoscope; and the bougie. The writer prefers to have a preliminary röntgenogram taken before any instrumentation. (In his cases he has been greatly assisted by the able coöperation of Doctor LeWald.) Occasionally this procedure is not a feasible; but it is a safe rule. If it is done the oesophagoscope cannot be used to advantage the same day on account of the residue frequently remaining to obscure the field of vision. Position will help in oesophagoscoping these patients (Killian).² Examination by the Röntgen ray is most desirable, but is not complete without further aids. The oesophagoscope must finish it off, and the bougie or bulbous sound, which is most dangerous in the hands of the inept, is at this point a material aid when used through the tube of the oesophagoscope. By it one may determine the "feel" and the character of the constriction. When the diagnosis has been made both as to the nature, the locality, the extent and tightness of the stenosis, one can determine what method of attack he is to pursue.

The approaches are per oral (Lerche, Lanelongue, Plummer, Jackson

and Abbe), abdomino-oral (Abbe and Billroth), and transthoracic (Gossett³ and Fischer⁴).

The methods may comprise dilatation, or cutting or a combination of both.

In this class of cases the coöperation of the patient is most important; and this is generally obtained even in the case of young children, due to their dire necessity. Much help and an additional factor of safety may be gained by the swallowing of a silk thread. This is true whether the attack is through the mouth or through a combination of the oral and abdominal route. A guide in the canal is always a help. It may even give aid in using the endoscope. One cannot always persuade the infant to swallow a thread. In such cases a whalebone filiform bougie can be passed through the minute opening by direct vision, with the aid of the œsophagoscope (R. Abbe⁵ and N. W. Green⁶). The canal above the stricture is always basin shaped—below it, funnel shaped. In the röntgenogram this very feature is of great diagnostic aid in differentiating a benign from a malignant stenosis.

Abbe says it has "been demonstrated by Albert, Billroth, von Bergman, Maydl, and others that an œsophageal stricture which permits no bougie to enter from above will almost invariably permit it from below."

It is very difficult even by means of an endoscope to locate the cardiac end of the œsophagus from within the stomach. Abbe also has called attention to the difficulty of locating it by means of the palpating finger within the open stomach.

The method of cutting the stricture with a string used with a sawing motion while a retrograde bouginage was being carried out was devised by Dr. Robert Abbe some thirty years ago.⁷ I have found it safe and a most satisfactory procedure, especially in the strictures of some two and three inches in length. A gastrostomy preferably of the Senn-Kader type is a requisite, and fourteen days should elapse after its establishment before the attempt is made to carry out the Abbe procedure. The retrograde bougie of Billroth is contributory to carrying this out. One string tied in the eye advances the bougie and another passing alongside does the string sawing while the stricture is placed on the stretch by the bougie. This subjects only the strictured part to the attrition of the string. String cutting from above has also been practiced by Abbe with a string passing down through the mouth and back again over the shoulder of a tapered bougie.

Chevalier Jackson has used this procedure in modified form with the string cutting only on one side of the olive. He determines to which side to apply the cutting by means of the œsophagoscope. He applies the cutting to the side of the stricture which stands out farthest into the lumen of the œsophagus.⁸

A forcible dilatation of these stenoses by passing graduated olives, whose ends are armored with an insinuating spring tip, over a string six

yards long, most of which has been passed into and beyond the pylorus, after the method of Dunham and Mixter, has been advocated by Plummer.⁹ He says it is the purpose of his paper, written in 1910, "to again call attention to the value of a silk thread as a guide in dilating cicatricial stenosis," and to prevent the more general use he made of it during the five years previous to 1910, in the study of about three hundred lesions involving the Œsophagus. In his group of cases cited, he had eight cicatricial stenoses at the cardia. Plummer says: "Inability to differentiate obstruction from narrowing, and obstruction from pocketing, is responsible for the greater part of the reported mortality of from 10 to 15 per cent. from perforation, in cases of cicatricial stenosis; and the not infrequent deaths (not often reported) in cases of carcinoma and other Œsophageal lesions following the usual method of passing sounds."

This method has not been used by the writer, but it is appealing and practical. It should always be preceded by röntgenograms and an Œsophagoscopy. Aortic aneurism and varices may be pitfalls to cause regret. In 1865 Lanelongue performed internal Œsophagotomy with an instrument similar to that of Maisonneuve. The stenosis was at the upper end. A beautiful description of his experience will repay anyone for looking it up.¹⁰

A very comprehensive article on this condition was published by William Lerche in 1909. By his method the stricture is divided through the Œsophagoscope by a guarded cutting knife. It has many advantages.

When the strictures are not tight and are situated at the epicardia it has been possible to pass a small bougie through them by the aid of the Œsophagoscope. This can then be followed with Lerche's glove stretching dilator without cutting. Force is to be avoided and it is better to repeat the process than to do too much at the first sitting. The writer has done this in three cases with much satisfaction.

All these methods require occasional bouginage; at first often, later ranging from one month to three or six months' intervals.

Brief records of my cases are herewith appended.

CASE I.—D. B., female, aged three and one-half years, was admitted to the service of Doctor Abbe, St. Luke's Hospital, November 26, 1911, with the diagnosis of Œsophageal stricture. (This was Doctor Abbe's case in which I had the privilege of coöperating.)

Nine months before admission she swallowed some potash. From that time until admission there was a constantly increasing stenosis of the Œsophagus. Finally everything taken into the mouth was regurgitated. Emaciation was most evident.

On November 27, 1911, a gastrostomy by inversion of the stomach wall by repeated purse-string sutures was performed by Doctor Green. On December 22, 1911, the string-cutting dilatation of the Œsophageal stricture was performed by Doctor Abbe with the aid of a filiform bougie which was passed through the stricture under direct vision through the Œsophagoscope by Doctor Green. To this

filiform bougie a silk string was attached at the gastrostomy end and in turn brought out through the mouth. The stricture was opened up to a No. 29 F. bougie.

On December 26, 1911, she was discharged cured.

She came back some months later and had gained weight and could eat crackers.

CASE II.—C. D., male, aged three years, was admitted to the service of Doctor Abbe, St. Luke's Hospital, September 11, 1911, with the diagnosis of stricture of the œsophagus. (This was Doctor Abbe's case in which I had the privilege of coöperating.)

The history stated that the patient swallowed some concentrated lye April 11, 1910. He swallowed solid food for a short time after the burn had healed somewhat. The growth came on gradually. Later everything solid would come back immediately after an attempt to swallow.

A gastrostomy was performed on September 14, 1911. On November 3rd, and December 22, 1911, the string-cutting method of Doctor Abbe was carried out by Doctors Abbe and Green with the aid of a fine whalebone bougie passed under direct vision through an œsophagoscope. To the lower end of this filiform a silk thread was tied which was then drawn out through the mouth.

(The patient was in the hospital a much longer time than usual and was confined in the isolating ward from June 29, 1912, to July 13, 1912.)

The gastrostomy wound evidently did not close spontaneously and was closed by Doctor Schley on July 22, 1912. On August 17, 1912, he was discharged cured.

CASE III.—J. D., male, aged three years, was admitted to Surgical Division A, St. Luke's Hospital Service of Doctors Abbe and Martin, February 23, 1915, with the diagnosis of stricture of the œsophagus. The history on admission stated that the patient swallowed lye five months previously. Several röntgenograms were taken, but the findings were unknown to the parents. He had evidently been at another hospital. A note is made that a bougie No. 16 passed nine inches. By the Röntgen ray it was impossible to determine the calibre of the supposed stricture as the patient refused to take solid food. The liquid bismuth mixture passed into the stomach.

On March 5, 1915, an œsophagoscopy was performed by Doctor Green. The pathological findings were as follows: Stricture seen in the œsophagus, but the lumen not sufficiently occluded to warrant gastrostomy. (The stricture was at the epicardia.) Graduated bougies were passed through the œsophagoscope with the hope of dilatation. The patient was returned to the ward for further treatment by dilatation. On May 4, 1915, the patient was again œsophagoscoped and the stricture ten inches from the upper teeth was dilated through the tube to a bougie 6 mm. in diameter. On May 22, 1915, an œsophagoscope was again passed. There was a slight stricture detected at the upper end, and this was dilated and

the 'scope passed to the lower end and the main stricture dilated through the instrument to a 32 bougie. The tip of the above was passed into the stricture. He was discharged on July 16, 1915, improved.

On August 14, 1917 (two years later), he was readmitted after a history of vomiting two days, no loss of weight. On August 24, 1917, under light general anæsthesia an œsophagoscope was passed by Doctor Green and the stricture in the lower end of the œsophagus was dilated with a Lerche's dilator through the tube to about the size of a 32 F. bougie. He was discharged cured on August 26, 1917. Since then he has been dilated twice a year with a bougie.

CASE IV.—A. L., female, married, aged twenty-six years, was admitted to St. Luke's Hospital on April 29, 1916. The history on admission was somewhat as follows: When eight years old the patient drank some lye by mistake. She was treated by an outside physician for a year and then came to St. Luke's where the "string-cutting operation" was performed by Dr. B. Farquhar Curtis. This relieved her for eight years and then she began to have difficulty in swallowing; for the past four years she has been coming back and having bougies passed. Five days previous to admission the stricture had closed to the point where she could not swallow solid food, and two days ago she could not swallow fluids. She has lost weight and has become anæmic and weakened.

On April 29, 1916, the stricture was found through an endoscope to admit only a small filiform. It was dilated to 24 F. with bougies through a tube. It was probably three or four inches in length and was at the lower end of the œsophagus. The patient was somewhat intractable, and although eating soft food with discomfort, she did not consent to reënter the hospital till 1917, when she was readmitted on February 26th. As the dilatation of the stenosis from above was not satisfactory on account of the length of the cicatrix, another gastrostomy was performed on February 28, 1917. This was of the Senn-Kader type, and it was interesting to note the firm adherence of the stomach to the anterior abdominal wall at the site of the old gastrostomy made many years previously.

On March 14, 1917, an unsuccessful effort was made to pass the stricture from below. On March 20, 1917, a string which the patient had swallowed two days before was found protruding from the gastrostomy. The stricture had narrowed about the string and the smallest bougie passed with difficulty. With graduated Billroth bougies and the string-sawing method of Doctor Abbe the stricture was opened to the size of 41 F. A piece of tissue obtained at this time gave the following microscopical appearance as reported by Dr. Francis C. Wood: "The section shows a very thick layer of stratified squamous epithelium, underlying which there is a very fibrous connective tissue that is hemorrhagic and richly infiltrated with small round cells and many polymorphonuclear leucocytes. There are no glands in the section."

She was discharged improved on April 2, 1917. She was read-

mitted on December 11, 1919, with the following history: Since last admission (two years and nine months ago) the patient has had regular dilatation with the bougie every five or six weeks and on October 24, 1919, a 42 F. bougie passed readily. One day ago Doctor Green was unable to pass any bougie to the stomach, so patient reentered for further treatment and observation.

On December 12, 1919, bougies were passed repeatedly; 36 F. passed, but not as far into the stomach as previously. On December 15, 1919, she was discharged improved.

(She has since that time been returning to the office for bougie treatment about every six weeks, and by a specially designed bougie with an electric light in the end the passage of the instrument into the stomach can be readily determined by the transillumination.)

This case has been presented before the New York Surgical Society in November, 1917.

CASE V (Fig. 1).—K. M., female, aged two years, was admitted to St. Luke's Hospital, Surgical Division A (Doctor Martin and Doctor Downes), with a diagnosis of pyloric obstruction, February 16, 1917. At that time there was no operation and she was transferred to the Medical Division.

Her history on admission gave her chief complaint as inability to swallow with vomiting soon after taking food. Ever since birth she had been troubled with regurgitation. She could take milk, but very little solid food. Lately she seemed to vomit everything. Nothing seemed to enter the stomach. If water or milk were given very slowly it would seem to go down all right, but on drinking from a cup she could not keep anything down. She has never gained much weight, and in the last two weeks she has seemed to lose weight rather rapidly. She had been down at the Babies' Hospital for one week with no improvement. She was very constipated. The family history showed the mother to have had two miscarriages.

The röntgenographic report by Doctor LeWald, February 17, 1917, stated that the findings suggested pylorospasm or stenosis. There was a large five-hour residue. The findings were sufficient to justify surgical intervention for the relief of the stomach retention. After twenty-four hours and forty minutes there were apparently traces of the bismuth still remaining in the stomach. "This would offer definite indication for operative procedure." February 26, 1917, the following note was made by Doctor LeWald: X-ray examination points to pyloric obstruction, but manner of vomiting indicates some obstruction or diverticulum of the œsophagus. Patient transferred to Pediatric Service for treatment and observation.

She was admitted to the Pediatric Service (Doctors Collins and Gould) February 26, 1917, where she remained under careful feeding until June 24, 1917, and was much improved. So much so that she appeared strong and vigorous and walked and played around the ward. She vomited occasionally, and it was impossible

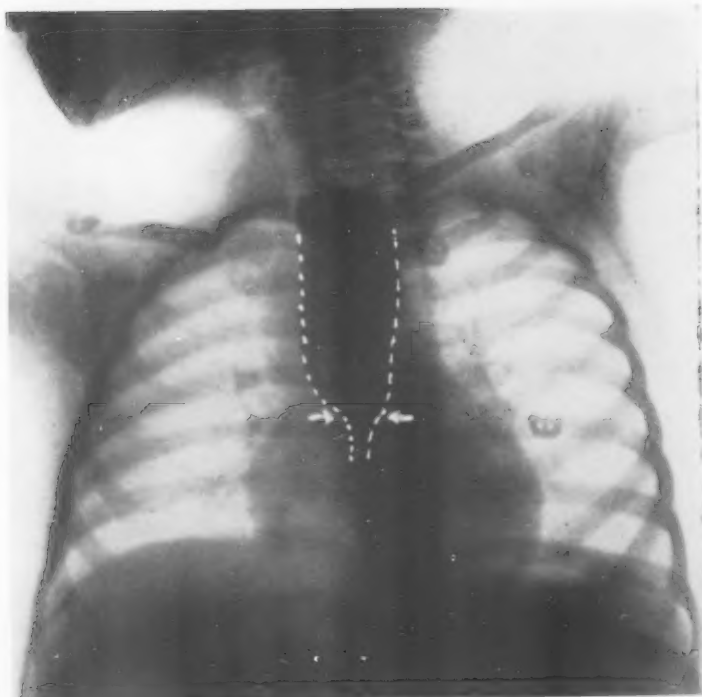


FIG. 1.—Case V. Benign stenosis of œsophagus (congenital.) Note the basin-shaped tendency of the dilated portion of the œsophagus. (Röntgenograms by Dr. L. T. Le Wald.)

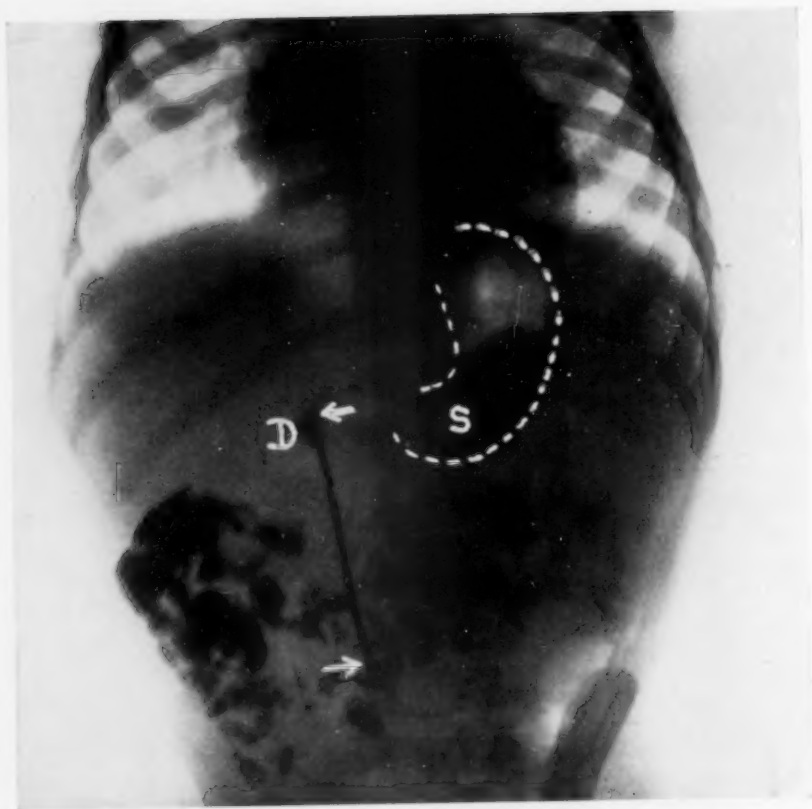


FIG. 2.—Case VIII. Spring tip of bougie in the descending portion of duodenum. (Röntgenogram of Dr. L. T. Le Wald.)

to pass a stomach tube except at long intervals. The gain was splendid at times, but stationary during the latter weeks.

On September 28, 1917, she was readmitted to the Surgical Division A (Doctors Martin and Downes), with the diagnosis of potential stenosis of the pylorus with adhesions and stricture of the œsophagus.

On November 30, 1917, a posterior gastroenterostomy was performed by Doctor Downes. Among the pathological findings at operation was a tight band of adhesions, probably congenital in type, extending from the flexure of the colon over the pylorus and well down to the posterior border of the liver past the neck of the gall-bladder. This was a very tight band and bound the pylorus well down to the posterior wall; it was also attached to the pylorus at a point where it passed over. At operation this band of adhesions was freed and cut away almost in its entirety, thus allowing the pylorus to come up anteriorly without constriction. Some improvement followed this abdominal procedure, but still the child regurgitated, and in the spring by the courtesy of Doctor Downes the patient was turned over to Doctor Green for œsophageal observation and treatment.

On May 29, 1918, an œsophagoscopy was done, and a stricture was located in the œsophagus near the cardia: it was almost pinpoint in size. It was dilated with a small bougie through the tube.

On October 7, 1918, the stricture was again dilated through the œsophagoscope with bougies.

On April 27, 1919, the patient was discharged. Able to swallow fairly well.

(She has been to the office about every three months since and is practically cured.)

CASE VI.—A. S., male, aged forty-eight years, was referred to Doctor Green by Dr. F. S. Mathews and was admitted as a private patient to St. Luke's Hospital, January 16, 1918. The diagnosis was stricture of the œsophagus. About four months previous to admission the patient, after exposure to the cold, drank sulphuric acid in mistake. Dysphagia progressively increased, and when first seen he could only swallow fluids and that with hesitation.

A röntgenogram taken by Doctor LeWald showed a tight stenosis of the lower one-third of the œsophagus, with the basin-shaped dilatation of the œsophagus above the constriction, which is characteristic of benign stenosis. He had a gastrostomy performed January 17, 1918, and later was dilated by the Abbe string-sawing method three times up to a 45 F. bougie.

At first, after leaving the hospital, he had his stricture dilated about every week, then each month, and later every three months, six months twice, and recently he went a year without bouginage. He is now cured.

CASE VII.—R. G., male, aged twenty months, was referred to Doctor Green by Dr. F. O. Virgin and was admitted to St. Luke's

Hospital on September 27, 1920. The diagnosis was œsophageal stricture.

The history on admission was as follows: He was unable to eat. About two months ago the child swallowed some lye. The mother gave it white of egg which it vomited. For several days the child seemed to have pain on swallowing. Since that time he had been able to eat only soft foods. For the past week the child had been able to take nothing by mouth. Family history negative.

September 28, 1920, an œsophagoscopy was performed by Doctor Green. The pathological findings were as follows: There was a slight ulceration and a narrowing of the œsophagus just above the cardia. Operative procedure was as follows: The œsophagoscope was passed under ether anæsthesia and the œsophagus investigated. The cardiac was dilated with a small bougie and also with Lerche's expansion dilator up to 30 F. October 1, 1920, the patient was discharged cured.

(The patient has been back once for a bougie in routine.)

CASE VIII (Fig. 2).—H. P., male, aged two years, was referred to Doctor Green by Dr. Robert Abbe and was admitted to the Surgical Service, Division A, St. Luke's Hospital, October 27, 1920, with the diagnosis of foreign body in the duodenum and stricture of the œsophagus.

The history on admission was as follows: The patient showed an inability to swallow solids. At the age of seven and one-half months he was said to have had diphtheria with symptoms of nasal obstruction. When eleven months of age, he regurgitated breast milk more than previously. He was then weaned, and it was found that he could not retain solid food. He was able to swallow, but there was apparently a low obstruction, above which the œsophagus filled up until the child vomited. There was no history of drinking lye. The child was otherwise well. He had not gained in weight as much as he should. He had no pain: gagged at night and took liquids well. The mother was told by the physician who had tried to dilate the œsophagus that a bougie tip had broken off and been lost, but that the child would surely pass it normally. He had not done so to date (November 9, 1920).

October 29, 1920, X-ray examination by Doctor LeWald showed that fluid mixture had apparently entered the stomach, indicating no obstruction in the œsophagus. The stomach was emptying at a fair rate. October 29, 1920, X-ray examination showed that there was a foreign body in the abdominal cavity. It was dense and of metallic nature, measuring about 8 cm. by 3 mm. At the upper end it was slightly rounded, while at the other it was square. It had the appearance of a portion of a probe. It appeared to be outside of the stomach and gave the impression of being entirely outside of the digestive tract.

November 3, 1920, X-ray examination showed that the body was still present and had not changed its location. The body retained

BENIGN STENOSIS OF THE ŒSOPHAGUS

its vertical position with the round end upward about in the median line.

November 9, 1920, the foreign body was removed by Doctor Green by a laparotomy. The tip of a dilator was removed through an opening situated on the cephalad end of the foreign body, which was in the duodenum, vertically. The upper end was one inch from the pylorus. The duodenum was closed in the usual manner and the abdominal wall without drainage. An œsophagoscope was then passed and the pathological findings were as follows: The œsophagus bled easily. There were some irregularities in the lower pharynx. The cardia was slightly constricted but not closed. The œsophagoscope passed rather easily after its introduction into the introitus. The cardia was dilated with Lerche's dilator to 30 F.

December 2, 1920, the patient was discharged cured.

(The patient has been to the office twice in routine since leaving the hospital.)

Further History.—After leaving the hospital the patient ate solid food till the latter part of January. Now, March 9, 1921, he takes only fluids. He has, however, gained two pounds in the past month. To-day in my office a 30 F. bougie passed easily.

SUMMARY

In all there were eight cases. Two were adults; six were children three years old and under.

One adult stenosis was due to sulphuric acid. One was recurrent after being treated in childhood.

One was without history of burn, and was unquestionably congenital. It was coupled with stenosis of the outlet of the stomach.

One in an infant gave the history of coming on after diphtheria.

All eight are improved. All but one are cured with the necessity of occasional bouginage. One requires at the present writing further slight dilatation by the oral route. Four had the string-sawing operation of Abbe. These were the worst cases and have done very well. Four had dilatation through the œsophagoscope and were not treated so vigorously. The results are as good, but all kept track of are dependent upon following up with the bougie.

The longest interval in the last six cases in which the bougie has not been passed is a year.

In the milder types of stricture dilatation through the œsophagoscope is sufficient. In the severer types the string-sawing operation of Abbe is indicated.

BIBLIOGRAPHY

- ¹ Lerche, William: A Contribution to the Surgery of the Œsophagus, with the Report of Five Cases of Cicatricial Stricture Treated by Cutting Through the Œsophagoscope. *Surgery, Gynecology and Obstetrics*, October, 1910, vol. xi, p. 345.

- ³ Killian, G.: *Short Hints for Examining the Oesophagus, Trachea and Bronchi by Direct Methods.* 1903.
- ⁴ Gossett, A.: *Revue de Chirurgie*, 1903, xxviii, p. 694.
- ⁵ Fischer, H.: *Transthoracic Cardiotomy. A New Method for the Cure of Impassable Benign Stricture of the Oesophagus.* *Surgery, Gynecology and Obstetrics*, May, 1911, vol. xii, p. 476.
- ⁶ Abbe, R.: *Oesophageal Strictures.* *St. Luke's Hospital Medical and Surgical Reports*, 1911, vol. iii, pp. 19-21.
- ⁷ Green, N. W.: *Five Cases of Oesophageal Obstruction from Three Different Causes.* *St. Luke's Hospital Medical and Surgical Reports*, 1911, vol. iii, pp. 90-94.
- ⁸ Abbe, R.: *A New and Safe Method of Cutting Oesophageal Strictures.* *Medical Record*, February 25, 1893.
- ⁹ Jackson, C.: *The Surgery of the Oesophagus Laryngologically Considered.* *Laryngoscope*, October, 1909, vol. xix, p. 745.
- ¹⁰ Plummer, H. S.: *The Technic of the Examination of the Oesophageal Lesion.* *Transactions of the Section on Surgery, American Medical Association*, 1910.
- ¹¹ Lanelongue: *Observations avec quelques considerations; pour servir a l'histoire de l'oesophagotomie interne, etc.* *Memoire lu à Bordeaux, le 4 Octobre, 1865.* Sur la 3e question posée par le Congrès Medical de France.
- ¹² Carman, R. D.: *Röntgen Diagnosis of Disease of the Alimentary Canal.* W. B. Saunders Co., Phila., 1920, p. 50.

MECHANICAL FACTORS IN THE MANAGEMENT OF RECENT EMPYEMAS*

BY FRANK S. MATHEWS, M.D.
OF NEW YORK, N. Y.

IN the treatment of empyema, our aim is to preserve life, to avoid permanent sinus and to bring about healing as quickly as possible. With preservation of life foremost in our minds at the beginning of treatment, we will often find it inadvisable to do a thoracotomy at once. In desperate cases, with septicæmia, pneumonia of the same or opposite lung, circulatory embarrassment or even extensive bronchitis, delay will be safer for the patient. The immediate indication is best met by aspiration of as much fluid as possible once or maybe several times. By aspiration, the lung is put in a position to be in some degree functional instead of being thrown for a time out of employment.

But the aspiration treatment has its limitations. Some empyemas, especially the pneumococcus ones of children, begin with a solid exudate which later liquefies and in many of these cases there is so much fibrin in the exudate that aspiration in the sense of keeping the cavity empty is difficult or impossible. Aspiration, too, has its dangers. At times the lung is punctured so that air is pumped through it and produces pneumothorax or subcutaneous emphysema. When this condition develops, free incision is indicated at once to relieve the circulatory and respiratory embarrassment. The aspiration treatment lends itself well to the treatment of some of the streptococcus cases. In a recent case, in a young girl, a single aspiration removed two litres of thin streptococcus pus. Two days later thoracotomy under local anæsthesia was easily borne and healing was complete in three weeks. I have seen a streptococcus empyema apparently cured by repeated aspirations only to have the opposite lung develop an abscess which later ended fatally. Nor is it likely that repeated aspirations, accomplished without the entrance of air, delay the time of final healing, even though they postpone thoracotomy, for there is no better means available of bringing a compressed lung into immediate contact with the chest wall. As a general proposition, the thinner the exudate, the more suitable the aspiration treatment and the greater are the objections to the opening of the chest wall—such as flapping of the lung and displacement of the mediastinum. When the exudate is thick and fibrinous, we expect to find a definitely lined cavity, that is, there are adhesions sticking the lung to some of its surrounding

* Read before New York Surgical Society, March 24, 1920.

structures so as to steady the mediastinum and limit the flapping of the lung itself.¹

Discussion of anæsthesia and operative details will be omitted in this paper, as its purpose is to call attention to other matters. Thoracotomy has for its aim the *immediate, complete, and continued* drainage of the pleural cavity. This statement will be so generally accepted that it almost needs an apology for mentioning it. It is on the basis of free drainage alone that the great majority of empyemas in the past, the world over, have been treated, and usually with success in bringing the lung to the chest wall with final healing. There are failures, but omitting those due to retained foreign bodies, there seems little doubt that most of the failures result from insufficient drainage. The opening narrows down and becomes inadequate while an infected cavity remains. This may occur even with the drainage tube still in place, for free drainage around the tube becomes less as healing continues and the end of the tube may be closed at each expiration by the lung or diaphragm. In fact, the usual double-barrelled tube drain is chiefly useful in keeping the wound edges apart to permit drainage between and around rather than through the tubes.

At intervals there arise advocates of treatment based on two other principles: First, the antiseptic treatment of the cavity, and second, the suction method. The profession seems loath to abandon the suction principle and has displayed great ingenuity in devising apparatus with this end in view, and yet the problem of making a joint between human tissues and other materials that shall be air- or water-tight for any considerable period, seems as far as ever from solution. So soon as a suction apparatus fails to suck either from plugging of the tube or from failure of the joint to be air-tight, there may result, *first*, a pneumothorax with embarrassment of breathing; *second*, failure of drainage—the sine qua non of success; *third*, interference with the usual mechanism by which in the open chest the lung is brought back to the chest wall. Why does the elastic lung, once the chest has been open, ever expand to fill its place again? Conversation and reading lead one to the belief that there are many views on the subject. The matter is admittedly hazy in many minds. When the lung is said to expand to fill the space, one should not

¹ With the knowledge that the aspiration or aspiration and injection treatments cure some cases, there is growing up a tendency to continue the treatment too long. During the progress of a case under aspiration, the general condition may for a time very considerably improve. The patient seems not so sick and the temperature may remain only a little above normal. This, however, does not indicate necessarily that the patient is going on to recover without a thoracotomy. The more important guide would seem to be the rapidity of recurrence of exudate. If, with subsidence of the toxæmic symptoms there is not a rapid diminution in the amount and rate of formation of the exudate, one should abandon the idea of a cure by this method. If persisted in, the lung may become so fixed in the compressed position as to delay the obliteration of the cavity after thoracotomy.

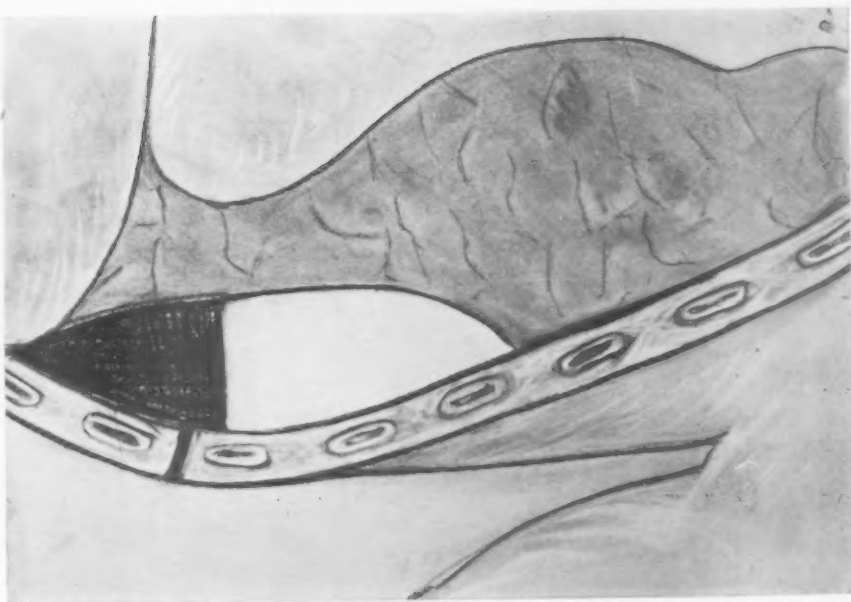


FIG. 1.—Small cavity partially filled with air and liquid after removal of drainage tube.

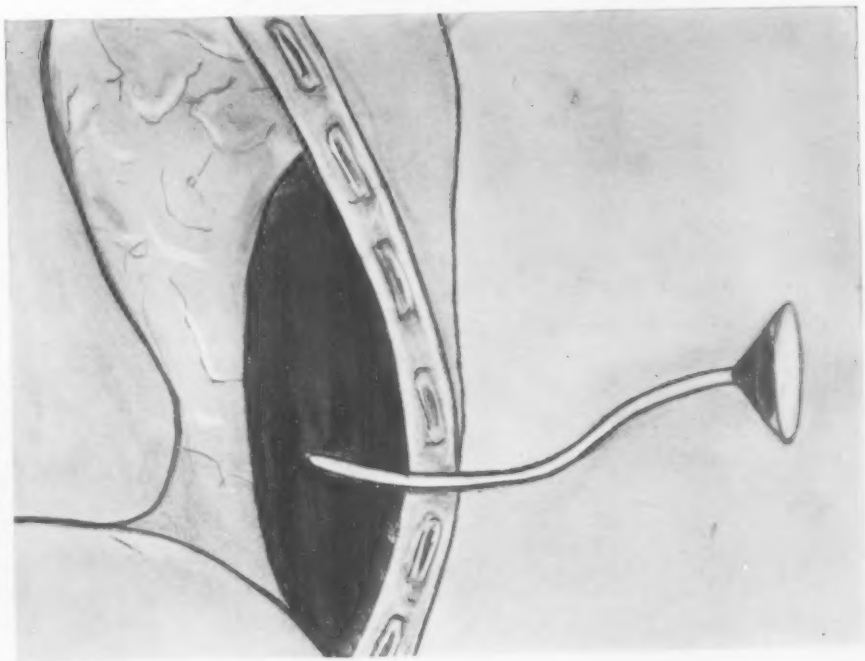


FIG. 2.—Patient on side; same cavity filled with fluid replacing air.

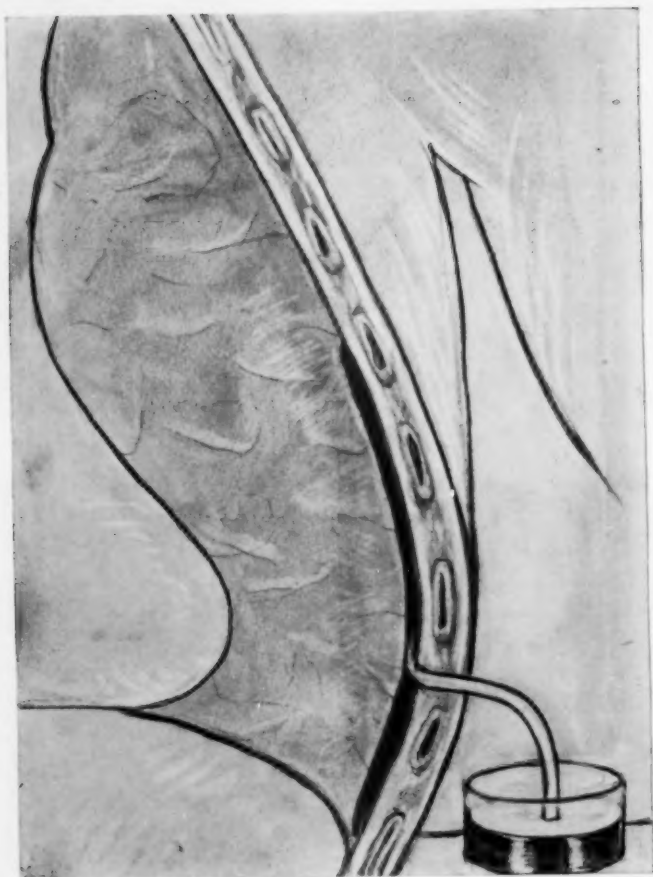


FIG. 3.—Catheter end under water. Fluid largely evacuated, bringing walls of cavity into apposition.

think of the lung as taking any active part in the process. The lung can only contract in virtue of its elastic fibres.

During quiet respiration in the unopened pleura there is a constant, varying, but always negative pressure. It rises roughly from about minus ten to minus two millimetres of mercury with each respiratory cycle. Intrapulmonary pressure, however, is alternately positive and negative even in quiet breathing. The amount of positive pressure required to make air escape through the unobstructed trachea is very little. Conditions are enormously different, however, in forced expiration. Here pressures as high as plus eighty millimetres of mercury have been recorded in the trachea and pleura and we have all witnessed demonstrations of the force of this positive pressure when, during a thoracotomy, the patient coughs and pus is driven to a distance from the wound.

I believe the positive pressure of forced expiration and coughing is the only efficient force expanding the collapsed lung and bringing it back to the chest wall. Adhesion of moist surfaces and fibrous adhesions may aid in holding the pleural surfaces in contact, but their agency is secondary. The lung, like a toy balloon, expands only when some one blows in it. Clinically, we observe that a large amount of expansion of the lung occurs during the operation itself, and physical signs show in favorable cases that in a day or two the lung nearly fills the chest. This has involved the stretching out of adhesions which in the recent case are fibrinous and give easily and are not comparable to the organized vascularized adhesions which might be encountered in a chronic empyema. This early expansion presupposes an easy exit from the pleura of both liquid and air and should make one cautious about the use of suction apparatus which, if it fails to suck, not alone fails in its purpose but inhibits the expansion of the lung by the old reliable method of intrapulmonary, positive pressure. A cushion of air in the pleura is to be strenuously avoided.

The expanding force of expiration acts but intermittently, and one may ask why the lung does not fall away between respirations and hence fail to bring about a permanent expansion. It has been urged that the expansion only can be maintained after the thoracic opening has become smaller than the chink of the glottis. If this were so, we should only expect late rather than early postoperative expansion of the lung, which is directly contrary to clinical observation. *The stabilizing of the lung's expansion is dependent on valve action at the thoracic wound and largely independent of its size.* If the exit of fluids is free and the entrance of fluids restricted, we have just the condition necessary to maintain lung expansion. For free exit of fluids—either air or pus—we need an adequate opening and the valve action is contributed by a dry—or better, a wet—dressing over the tube end or wound. Pus and air escape readily, but there can be no question that the pus-soaked dressing over the wound mouth offers a considerable amount of obstruction to the entrance of air to the pleural cavity. At a later stage, when tubes are removed,

an efficient valve action is supplied by the edges of the wound itself. These being in contact interfere with the drawing in of air even when pus may be discharging freely. I believe we will advance the interests of our patients if we keep steadily in mind that *valve* action at the wound is essential to healing and drop all efforts to replace it by any form of suction.

Our caution in the past has made us drain much longer than is necessary. We thought the cavity must heal down to a sinus to make the removal of the tube safe and we feared to irrigate, hence we were but vaguely informed as to the size of the cavity and whether it was real or potential, *i.e.*, a cavity with walls in contact.

In my cases, I have depended in the early days after operation on free drainage only and no irrigations, hoping to get the lung well up to the chest wall promptly as the result of the wide opening with valve action. In the removal of the drain, I am guided by disappearance of temperature and diminution of discharge and change of its character; and to a large extent by information gained by measuring the size of the cavity. The patient lies on the sound side and liquid is run into the cavity through a tube until the cavity is filled. The patient then sits up and the cavity is measured in this position. A cavity of several ounces capacity in the horizontal position may have its walls nearly in contact in the erect position. When the cavity will only hold a few ounces the tube is removed, after which, beside watching for a rise of temperature, one may proceed as follows: Insert a catheter daily to know whether the drainage is satisfactory. If pus is found in the pleura instead of on the dressing, the tube is returned. Should the return of a drain not be considered necessary, the patient is placed on his side, a catheter is inserted and the cavity filled with water to replace all air by gravity—never by forceful injection. Deep breathing by the patient will aid considerably. We now know the size of cavity in the recumbent position by the amount of fluid injected. Then with cavity full of liquid, with the catheter in place, put the outer end under water and let patient sit up and breathe deeply. At times a part and at times all the fluid escapes. If it does so in absence of air, the walls of the cavity must come into contact. The tube is then removed and dressing applied. The valve action of the end keeps air out, but the injected fluid—if some has remained in the cavity—gradually is expelled through the sinus and must bring the lung to the chest wall.

By the method outlined, we aim to shorten the time of healing by the early removal of the drainage tube and then keeping ourselves informed, first, as to whether drainage is continuing; second, as to the size of the cavity from day to day with patient in horizontal and upright position; third, by exclusion of all air and filling cavity with liquid we compel the lung to expand as fast as the liquid escapes from the sinus; and fourth, by thinning the discharge with our irrigating fluid, we favor its expulsion.

With those who wish to employ antiseptic methods in the treatment

MANAGEMENT OF RECENT EMPYEMAS

of empyema, I have no quarrel unless they use a method which supplants drainage—as, for instance, when a measured quantity of pus is aspirated and replaced by the antiseptic, though such treatment is sometimes successful. However, it is indisputable that empyema can be quite satisfactorily treated without antiseptics and the question for each one to decide for himself is whether he can shorten the healing of the average case or keep some case from going on to the stage of chronic empyema by their use.

When I first heard of empyemas treated with Dakin's solution and then closed by suture in about ten days, I must admit to a considerable degree of interest and surprise. More recently the suture method seems to have been abandoned and I have come to the conclusion that the successful cases were of the type of empyemas that might possibly be cured by aspiration and that I have seen heal in two weeks by methods detailed above. However, there are incidental advantages from the use of Dakin's solution in empyema.

In employing fluid to measure a cavity and to replace air, Dakin's solution possesses the advantages that it is non-toxic, mildly antiseptic, and liquefies the pus and fibrin. There would seem to be less danger of mixed infection of the cavity under its usage than when a bland fluid like salt solution is employed. As I have employed it once a day to measure a terminal cavity and to replace air in it, it can hardly be credited with contributing much to the chemical sterilization of the cavity. It seems to me that the antiseptic treatment of a cavity would be most useful toward the termination of a case if there was reason to believe that the cavity was not cleaning up under drainage alone and that its size had reached a standstill. Even here, I should suspect that some mechanical fault was related to the delay in eliminating infection.

CONCLUSIONS

1. The percentage of recoveries in empyema will be increased by more frequent resort to aspiration.
2. A wide thoracotomy will not delay but hasten healing by favoring the early lung expansion.
3. Valve action at the wound is essential to healing.
4. Fear of irrigation of small cavities should be abandoned.
5. Delay in obliteration of a small cavity may depend on contained air.
6. Measurement of cavities from time to time is desirable as a measure of progress in treatment.
7. The walls of a cavity may be approximated by replacing air by liquid, on the escape of which the cavity is left empty, *i.e.*, with walls in contact.

Interest, experience, and painstaking are desirable at every stage in the management of empyema. Operation is a very small part of it.

CLINICALLY DOUBTFUL BREAST TUMORS: THEIR DIAGNOSIS AND TREATMENT

BY EDWIN I. BARTLETT, M.D.

OF SAN FRANCISCO, CALIF.

INSTRUCTOR IN SURGERY AND SURGICAL PATHOLOGY, IN THE UNIVERSITY OF CALIFORNIA

(From the Division of Surgical Pathology, Department of Surgery, University
of California)

IN 1894 the complete breast operation for cancer of the breast was described by Halsted¹ and a few weeks later by Willy Meyer.² This operation was based upon pathological studies regarding the local growth and methods of metastasis. Since that time much has been added in the way of study of the cellular pathology of cancers, the study of other tumors or lesions in the breast, and the development of operations for other conditions. There have been some modifications of the original operation for cancer as regards skin incision and order of the steps in the operation, but the principles are the same. There has always been a high mortality in cancer of the breast, not due to the lack of knowledge of surgical procedure in recognized cancer, but rather to the late or hopeless stage of the disease when the patient presented herself to the surgeon.

A few years ago, under the leadership of the American Medical Association, an educational campaign was inaugurated for the purpose of informing the public about the various breast diseases, and especially with the object of impressing upon them the necessity of early intervention if cures are to be expected. Already some clinics have been able to demonstrate by statistical studies that cancer is coming to operation much earlier in its course, that more benign tumors are being seen, and that many more cases of cure are recorded in cancer. In fact, the campaign has been so successful that we find ourselves confronted by an avalanche of tumors that are not clinically cancer according to our previous standards, and we are, as a profession, unprepared to take care of these cases intelligently because we are not sure as to the condition with which we are dealing. If, therefore, we are to keep pace with our education of the laity in regard to coming early for operation, we must seriously and definitely work out, if possible, a solution for the problem of diagnosis.

In our unprepared state we have reacted rather differently to these new conditions, and the type of reaction has been largely the result of individual or small group impressions. Very little has been done outside of a few larger clinics, in the way of actual scientific or practical study of the problem. The average man who attempts breast operations chooses one of three methods of dealing with the situation.

The first group, and the one that probably has studied the pathology and treatment more extensively than the others, has taken no chances

DOUBTFUL BREAST TUMORS

and has removed by complete operation all the tumors that are frankly cancer or doubtful clinically. They have not failed to cure the early cancers, but they have been compelled to do complete operations where after-studies showed that a local operation would have sufficed. This would not be a serious objection in many ways were it not for the fact that this wholesale removal of breasts has reacted on the patients, and not a few of them are willing to take their chances rather than suffer unnecessary mutilation.

The second group, the class that is more interested in immediate results and avoidance of mutilation, looks upon all doubtful tumors with suspicion and prefers not to do a complete operation in any case in which cancer has not been proven clinically. These individuals remove the breast alone or simply enucleate the tumor, send the material to the laboratory, and upon report of carcinoma, proceed with the radical operation. The surgeons in this group sacrifice no breasts unnecessarily, but fail to produce a permanent cure in practically every case of cancer which is doubtful clinically.

The third group, the almost totally unprepared class as far as knowledge of pathology and treatment of breast conditions is concerned, prefers to procrastinate till the symptomatology is plain and unmistakable, or they fall into the error of applying salves or escharotics, or equally meddlesome methods. Their methods and results are not far removed from those of the various charlatans. It is needless to say that they never obtain a permanent cure in cancer cases.

We are all agreed that the only way of properly treating a cancer of the breast is the complete removal in one block of the breast with all the primary lymph-vessels and lymph-glands which drain the breast.³ Experience has also shown that the incision through the skin and the subcutaneous tissues should not divide any of the lymph-vessels on their way from the breast to the primary lymph-nodes. This means that the treatment of cancer which gives the patient the highest number of chances of cure does not include any two-stage operation,⁴ and we are all agreed that the removal of the breast or the tumor and the subsequent removal of the pectoral muscles and axillary contents after the diagnosis has been made is highly improper and lessens the patient's chances to a marked degree. If this be true then we must not expose ourselves to two-stage operations, if our objective is first of all the patient's safety. On the other hand, if we are to avoid unnecessary mutilation we must find some means of arriving at a diagnosis in doubtful cases. It is appropriate to conclude, therefore, that the most important problem in breast lesions to-day is that of early and proper diagnosis and confirmation of this diagnosis before the patient leaves the operating table.

In the study of the literature and of our own cases, we are able to confirm the following facts in regard to the well-known clinical signs and symptoms of breast conditions.

Pain.—The presence or the absence of pain in a tumor of the breast taken alone means nothing (Table II). Very frequently, however, a benign tumor is painful and usually the pain with malignant tumors is a late development. A lump that is painful and tender only at periods we have found invariably to be benign and usually of an adenomatous variety; the degree of pain apparently depending upon the amount of parenchymatous elements composing the tumor. If the mass is cancer and painful there are usually present other signs which lead to a diagnosis of cancer. Early pain, therefore, while not an absolute sign of benignancy, might be taken as all but positive evidence against cancer in the absence of any signs of malignancy.

TABLE I

108	Benign	Malignant	Remarks
Total cases.....	38	70	Total number benign and malignant, 108.
25 under.....	3	0	Fibro-epithelial tumors.
Skin changes.....	2*	39	* Recent trauma with skin discoloration (1); lipoma with skin fixation.
Nipple changes....	1*	31	* Old trauma with deep buried contracted scar.

TABLE II

108	Benign		Malignant		Remarks
	Yes	No	Yes	No	
Pain.....	22	12	35	26	Nine malignant tumors without data and four benign without data.
Multiplicity.....	7	31	4	66	Eighteen per cent. benign showed multiplicity; five per cent. malignant showed multiplicity.
Glands.....	9	29	45	25	Twenty-three per cent. benign with glands; sixty-four per cent. malignant with glands.

Lump.—It is generally understood that benign tumors are encapsulated, while malignant tumors are not. The matter of encapsulation cannot be determined clinically, but there are degrees in the definiteness or the indefiniteness of the limits of the growths which aid in arriving at the diagnosis. Thus a benign tumor, while it may be bosselated or irregular on its outer surface, gives the sensation of being covered by a capsule and slips about under the palpating finger. On the other hand, a malignant tumor usually does not slip about freely under the palpating finger and does not give the sensation of being covered by a capsule, because in the majority of cases the adjacent structures are closely adherent to the outer surface of the tumor. Again, the relation of the tumor to the rest of the breast or the breast lobulus from which it arises is of considerable help in drawing a conclusion. A benign tumor of the fibro-epithelial type is seldom buried entirely in the breast tissue. This type of tumor has a tendency to grow away from the lobulus at times with a

rather narrow base of attachment. Malignant tumors and the various types of abnormal involution (chronic cystic mastitis, senile parenchymatous hypertrophy) nearly every time are buried in or involve the body or substance of the lobulus. Involvement of a quadrant of the breast, that is, the involvement of all of one, or of more than one lobulus invariably means abnormal involution and not cancer. This is not a positive point, however, because cancer may develop in the midst of and be obscured by an abnormal involutional process.

Multiplicity.—Cancer at the onset nearly always is single, while benign tumors are frequently multiple from the beginning (Table II). Multiplicity is never a positive sign of benignancy, but in the presence of tumors of doubtful nature with strong benign characteristics it might be considered as confirmatory evidence that the tumors are benign.

Age.—The chance of malignancy in any tumor of the breast, regardless of the clinical signs, in a woman under twenty-five years is very remote. Bloodgood had one case in 885 malignant tumors.⁵ Age, therefore, may be taken as a positive factor when the patient is under twenty-five and when the clinical picture favors benignancy (Table I).

Nipple Changes.—Congenital retraction of one or of both nipples or acquired bilateral retraction is of no special diagnostic significance. Unilateral acquired retraction should be considered as diagnostic of malignancy if associated with a tumor mass⁶ (Table I). Apparently there are occasional exceptions to this rule, as, for example, severe injury to the breast with a deeply buried scar will sometimes result in nipple retraction due possibly to the contracture of the scar. This condition, however, is so extremely rare that it does not disprove the rule, that unilateral acquired retraction of the nipple means malignancy.

Skin or Fat Changes.—No benign condition ever causes true atrophy of fat with shortening of the trabeculæ or any of the other more advanced skin or subcutaneous changes such as dimpling or œdema.

(Occasional exception, see Table I and J. C. B. Bibliography No. 7. These exceptions are easily recognized, however, and do not disprove the rule.)

Therefore, any dimpling, œdema or discoloration associated with a tumor should mean malignancy (Table I).

Glands.—The presence or the absence of axillary glands is of very little diagnostic significance (Table II). If the condition in the glands is malignant the tumor in the breast is invariably either cancer or extremely doubtful, and the diagnosis is arrived at without taking into consideration the glands. Furthermore, the enlargement of the glands is quite a constant finding in abnormal involution. The time of the appearance of the enlarged glands in the course of the development of the breast tumor oftentimes is of some diagnostic significance. In cancer gland involvement is one of the late signs, while in inflammatory condi-

tions or abnormal involution the glandular enlargement follows close on the appearance of the breast lesion.

In summary, therefore, we find that we are in agreement with Bloodgood in that the clinical studies enable us to arrive at a positive diagnosis only in cases where there are skin changes or in cases of acquired unilateral retraction of the nipple, or in cases of a lump in the breast of women under twenty-five.⁸ It is a well-known fact, however, that a large majority of breast tumors are "clinically doubtful" and the diagnosis must be arrived at by some means other than clinical studies. Our only help outside of the clinical pictures comes from pathological studies, and if the diagnosis is to be made before the patient leaves the operating table, these studies must be done at the operating table.

If the solution of this problem is the study of the pathology of breast lesions at the operating table, then every surgeon that operates upon the breast should be familiar with the gross and microscopic pathology or should have always at his command at the operating table a pathologist for immediate gross or frozen-section diagnosis.⁹

The study of the pathology of breast tumors at the operating table is best brought about by the means of an exploratory incision. In the opinion of various contributors one has a choice of three proceedings, namely: (1) Enucleation of the breast gland, (2) excision of the tumor with a narrow zone of breast tissue, and (3) exploratory cutting down onto or into the tumor before removal. The first procedure is time consuming and divides every primary lymph-vessel from the tumor to the skin, to the axilla and to the mediastinum. All authorities are agreed that this is an extremely dangerous procedure and should not be practiced.

The second method, that is, excision of the tumor with a zone of breast, does not involve the division of all of the skin lymphatics but does mean cutting across every other lymphatic from the tumor. It is argued that the interval between the division of the lymphatics about the tumor and the accompanying dissemination is so brief that the cancer cells do not have time to travel beyond the limits accessible to the knife in the complete dissection. This may be true, but in view of the fact that we have no lymph-glands as filters and relay stations between the tumor in the breast and the inaccessible glands beneath the sternum, it would seem that one were taking considerable chances. While this method has not the objections of the first, still its objections are too numerous.

The third procedure and the one advocated by Bloodgood¹⁰ is the cutting down by radial incision directly upon the tumor, and as soon as the diagnosis is made or the necessary piece taken, the whole wound and tumor are thoroughly carbolized. After a few trials and a thorough study of each case, one can make a diagnosis from the gross appearance alone in a very high percentage of the cases. In these instances one has almost entirely avoided dissemination because the carbolic is applied immediately after the incision with a resulting immediate and complete coagulation.

The incision is made directly over the tumor and lies in the radius of a circle of which the nipple is the centre. Hemorrhage is very carefully controlled to prevent staining or discoloration of the tissues. It is very necessary that the wound be kept dry because the diagnosis rests upon the appearance of the tumor and practically not at all upon its consistency, etc. While the lump is held very firmly between the fingers the cut is made directly down upon it (Fig. 1). If the lump is not held firmly between the fingers, the knife is very likely to miss the tumor, especially if it is small. This point we have seen illustrated in one recent case. As the tumor is approached the behavior and condition of the aureolar and breast tissue is very carefully observed. If a bluish color is seen, the diagnosis of a cyst is made. The finding of a blue tumor is always considered evidence of benignancy. The cyst is laid open and the incision is carried beyond the cyst completely through the breast lobulus. This is done because the presence of a cyst very often means abnormal involution and there may be other changes in the breast about the cyst. If evidence of abnormal involution is discovered, other incisions are made lateralward in the breast tissue for the purpose of determining, if possible, the extent of the change.

(In one recent case with large multilocular and adjacent cysts containing clear fluid, some fragments of friable threadlike papilloma were found, and a cancer was discovered in the wall of cyst only by carefully cutting into all the cysts. One cyst proved to be solid and to be cancer.)

If no bluish color is seen, the next point for determination is the presence or the absence of encapsulation. The condition of encapsulation is demonstrated, of course, by the presence of a capsule or sheath entirely surrounding the tumor. This means that the surrounding connective tissue is not adherent to the tumor; accordingly as the aureolar tissue or the breast tissue is divided over the tumor under tension, the cut edges retract and the tumor has a tendency to suddenly pop into view (Fig. 2). This phenomenon is in marked contrast to that observed in cancer, where one usually finds that he is into the tumor while he is still looking for it. In cancer the growth is infiltrating and there is no capsule, therefore, the tissue immediately adjacent to the tumor is firmly adherent at all points. Because of this fact, the tissue over the tumor cannot be retracted under tension (Fig. 3). If the tumor fails to show the phenomenon associated with encapsulation, then a conclusion of malignancy is arrived at and the complete operation is immediately done. It is true that not all definitely localized masses in the breast which fail to show encapsulation are cancer, but the group is so small and at best the tumor is doubtful and deserves to be treated as cancer.

If an encapsulated tumor is discovered the mass is divided from end to end and the edge and the cut surface closely examined. This is done because some malignant tumors, that is, sarcomata and certain types of

cancer, developing from cystadenomata or arising from a papilloma in a cyst, may retain for some time a rather distinct capsule. Furthermore, when invasion beyond the rather sharply defined limits begins to take place, it is usually not an infiltration involving the whole surface, and

TABLE III

No. of cases	Clinical impression	Operative diagnosis	Pathological diagnosis	Remarks
26	Benign	Benign	Benign	Explored because local operation was planned. In one case found several smaller tumors and whole gland removed. This saved patient subsequent operations.
2	Benign	Benign	Malignant	Tumors encapsulated and granular. Incomplete operation followed by complete. Mistakes made early in study of exploratory diagnosis.
2	Benign	Malignant	Malignant	Two lives saved by exploratory.
4	Benign	.....	Benign	Diagnosis not attempted at operation and not known until pathological report.
4	Benign	.....	Malignant	Two-stage operation after pathological report was made from permanent sections. Patients probably dead.
3	Malignant	Benign	Benign	Three breasts saved by exploratory; retracted nipple from old scar (1), recent trauma with skin discoloration (1), lipoma (1). See Table IV.
11	Malignant	Malignant	Malignant	Proceed with complete operation with a certain diagnosis.
3	Malignant	.....	Benign	Three breasts sacrificed unnecessarily.
53	Malignant	.....	Malignant	Forty-three with skin or nipple changes, ten without skin or nipple changes.

TABLE IV *

Type of cases	No.	Remarks
Clinically benign (under 25)	2	Both bilateral.
Clinically malignant (skin or nipple changes).....	49	Nine were explored in spite of evidence. Three proved to be benign; these were recent trauma with skin discoloration (1), lipoma with skin fixation (1), retraction of nipple following deep hæmatoma eight months before (1).
Clinically doubtful.....	57	Thirty-two were explored. Seventeen were extremely doubtful, and diagnosis had to be made at exploratory. By exploratory three breasts were saved and two lives were saved. In the remaining eleven malignant cases we might have yielded to temptation of incomplete surgery had we not been able to make diagnosis at operating table.

* Based on study of 108 cases on which complete data could be obtained.

the original cut may expose only a portion of the circumference that does not show the infiltration.

If the borders of the tumor are quite sharply marked off from the surrounding tissues, and there is no indication at any point of infiltration,



FIG. 1.—Radial incision over tumor while breast and tumor are transfixed by free hand or by hand of assistant.

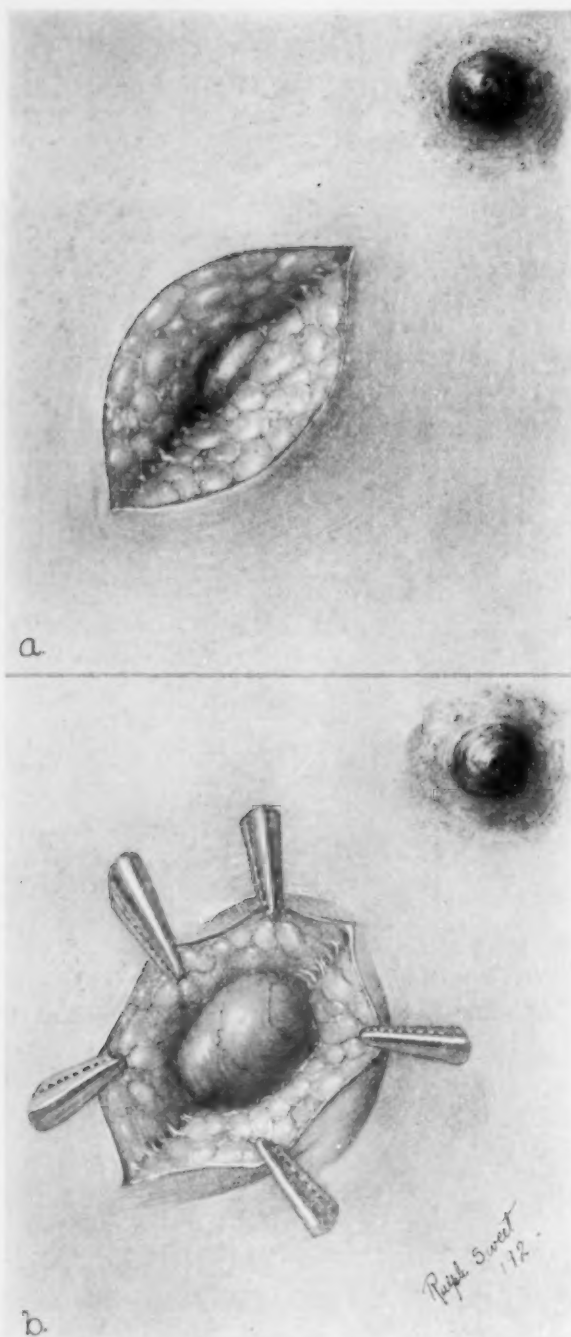


FIG. 2.—*a*, Radial incision through skin and alveolar tissue over encapsulated (benign) tumor. As tumor is approached, aureolar tissue retracts, showing dome of tumor; *b*, same as *a* with more of tumor exposed. Aureolar tissues retracts because it is not adherent to tumor except by blood-vessels.

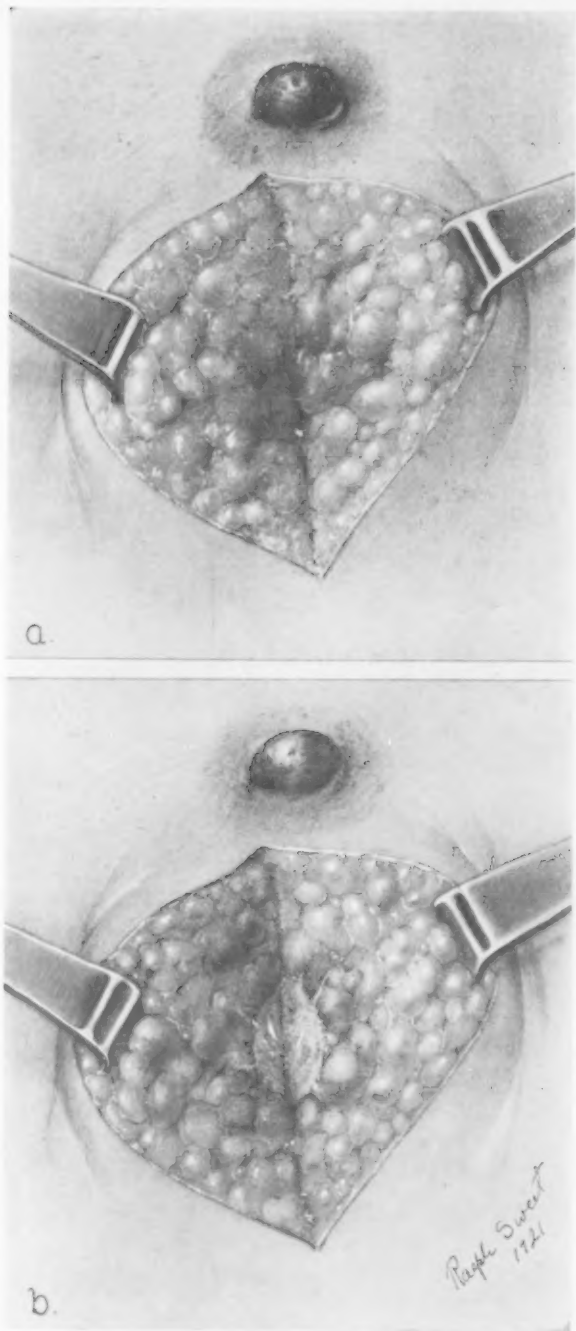


FIG. 3.—a, radial incision over malignant or non-encapsulated infiltrating tumor. Skin and aureolar tissue have been divided. With the palpating finger the tumor can be felt in depth of cut. There is no aureolar tissue over tumor yet tumor cannot be seen; b, incision a little farther cuts into the tumor. Infiltrating character is evident at a glance. Close scrutiny shows connective-tissue markings and pin-point necrosis.



FIG. 4.—Showing bulging of cut surface beyond capsule. On palpation the surface of tumor was rubbery and shiny. The surface was not granular, and no tissue could be scrapped away on the edge of the knife.

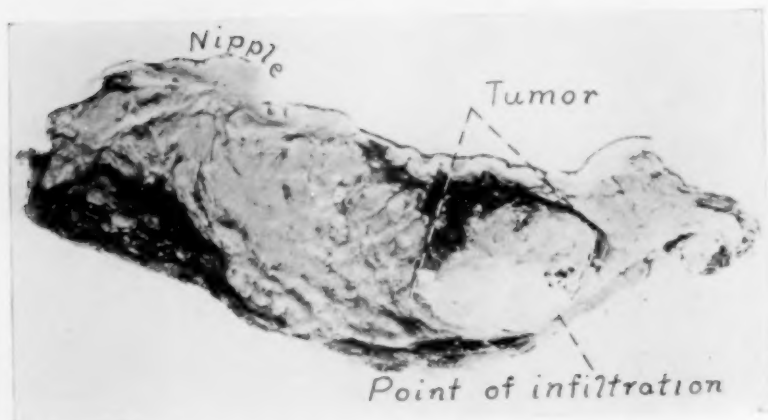


FIG. 5.—An encapsulated malignant tumor. Infiltration through capsule seen at lower right-hand border. Cheesy plugs can be seen. The surface was quite yellow and showed massive degeneration. The dark area at upper left-hand corner of tumor is blood-stained tissue from exploratory operation. Tumor from woman twenty-five years old, married, one child one year old.



FIG. 6.—The cut surface of a malignant infiltrating tumor showing total lack of encapsulation and tendency for surrounding tissue to bulge beyond the tumor instead of the tumor to bulge beyond the capsule; *a*, infiltration of connective-tissue; *b*, points of necrosis.

DOUBTFUL BREAST TUMORS

then the cut surface must be relied upon for the final proof of the character of the tumor. In a benign tumor the cut surface is rubbery and has a tendency to bulge beyond the cut edge of the capsule (Fig. 4). In a malignant tumor the tendency for the tumor substance to bulge beyond the capsule is very faintly shown or is not demonstrable (Fig. 6). In addition the surface is practically always granular, sometimes quite degenerated, and very often some of the tumor substance can be easily scraped away.

If the diagnosis cannot be determined by the above procedure, then the investigation of the microscopic picture is resorted to. The study of the microscopic pathology is a field so large as to well deserve the whole attention in a separate paper, and the interpretation of microscopic pictures is a field limited to those who have given considerable time and study to micropathology. The services of a well-trained surgical pathologist are invaluable, but such experts are not numerous even in the larger centres. The poorly trained pathologist very likely will be doubtful about or will misinterpret lesions whose nature is obvious in the gross to the surgeon who has carefully observed his gross pictures. The greatest possible effort, therefore, must be made on the part of the surgeon to perfect his gross diagnosis and the number of cases for microscopic diagnosis must be small.

By these studies and careful observation of our cases, we are able to arrive at a positive diagnosis in practically all of the clinically doubtful cases. There remains only a small group of abnormal involutinal conditions or rare tumors which may not be differentiated from cancer. This doubtful group we are compelled to treat as cancer. Comparatively speaking, this group is insignificant.

Treatment.—The discovery at exploration of a blue cyst without surrounding changes in the breast is treated by simple local removal of the cyst with a narrow zone of breast tissue. If the lateral incisions disclose further cystic involvement of the surrounding breast tissues, then a wider zone of breast is taken. If there seems to be an extensive involvement the whole gland is removed.

The finding at the exploratory operation of a benign fibro-epithelial tumor usually means that the tumor is removed locally with a narrow zone of breast tissue as in a simple cyst. If the tumors are multiple, the whole breast is sometimes taken in women who have passed the stage of lactation. In all other instances of multiple or single tumors the gland is preserved even at the expense of several incisions at one sitting or subsequent operations. The Warren type of procedure is used to advantage in some cases of multiple tumors after the diagnosis has been confirmed.

Summary.—Laying aside all other considerations and confining one's self solely to the problem of giving the patient the greatest number of chances of cure in malignant conditions, one must take into consideration not necessarily all but rather a certain few clinical signs and symptoms,

and one must do the complete operation or explore in every doubtful case.

The exploration should be done without delay. The breast should not be removed and an interval allowed to elapse between the time of removal and the pathologist's report. One should not remove the breast or the tumor for the purpose of immediate or subsequent pathological study.

One should cut down upon the tumor and should be sufficiently schooled in gross pathology to be able to make the diagnosis at a glance. Thorough coagulation with pure carbolic should be done immediately after the incision of a malignant tumor and then the complete dissection should proceed without delay.

No incomplete operation for tumor of the breast should be attempted in the absence of facilities for immediate diagnosis, and the diagnosis must be confirmed in every case before the patient leaves the operating table.

BIBLIOGRAPHY

- ¹ Halsted: *ANNALS OF SURGERY*, 1894, vol. xx, p. 497.
- ² Willy Meyer: *Medical Record*, 1894, vol. xlvi, p. 746.
- ³ Deaver: *Breast Anomalies, Diseases and Treatment*, p. 36. Halstead: *ANNALS OF SURGERY*, 1894, vol. xx, p. 497.
- ⁴ Bloodgood: *Treatise on Regional Surgery* (Binnie), vol. i, p. 583; *Ibid.*, p. 620.
- ⁵ Bloodgood: *Ibid.*, p. 558.
- ⁶ Bloodgood: *Ibid.*, p. 573.
- ⁷ Bloodgood: *Ibid.*, p. 575.
- ⁸ Bloodgood: *Ibid.*, p. 582.
- ⁹ Bloodgood: *Ibid.*, p. 582.
- ¹⁰ Bloodgood: *Ibid.*, p. 619.

CULTURES FROM THE APPENDIX

By CHARLES E. FARR, M.D.

OF NEW YORK, N. Y.

(From the Laboratory of Surgical Pathology of Cornell University Medical School)

THE problem studied in this paper is the infectiousness of the appendix. It is well known in a general way that the appendix is an infected organ, and that from it arise infections of the peritoneum and its contained organs and of the abdominal parietes during operative procedures.

This paper does not deal with the etiology of appendicitis, but with the bacterial content of the exterior of the appendix, and the meso-appendix, with its blood-vessels and lymphatics. It may be and probably is true that the organisms so isolated play a large rôle in the etiology of appendicitis, but the problem at hand was to determine the potential threat of the appendix to the peritoneum, its viscera, and the abdominal wall.

For the purposes of this study a consecutive series of appendices was chosen, including both chronic and acute cases but excluding all cases of perforation and of gross peritoneal infection. All of these cases were operated upon by me in the service of Dr. Charles L. Gibson at the New York Hospital, First Surgical, or Cornell Division. Cases showing perforation or peritoneal involvement were excluded because the true infecting organism is so quickly overgrown in such instances by colon and other hardier bacteria.

The technic followed was division of the crushed base of the appendix between clamps, with the cautery. Two small Kocher clamps are used, set as closely together as possible and well clamped. They are then rolled apart about one-quarter inch, leaving only a thin ribbon of peritoneum and muscularis to cauterize. In this way gross contamination of the field is fairly well provided against. The meso is divided before or after this step, according to convenience, and the appendix with the removed meso is at once dipped entirely beneath the surface of a broth culture tube, shaken gently, and removed. The cultures were then incubated and studied in the usual manner. No anaërobic studies were made. I am greatly indebted to Dr. George Wheeler, bacteriologist to the hospital, for his unfailing courtesy and friendly interest in the work.

The number and variety of infecting organisms may be noted in the accompanying chart. Conclusions must not be drawn from such a limited series of cases as to the etiology of appendicitis, nor the relative frequency of the various types of bacteria in and about the appendix. It does show, however, that the appendix is a contaminated organ, even

when there is not the slightest sign of acute infection, and that with the most careful technic, infection of the peritoneum and the abdominal parietes may ensue. Only the marked resistance of normal tissues to bacterial invasion prevents more frequent post-operative mishaps.

The subjoined table of 131 consecutive cases shows the colon bacillus, alone or with other organisms, in 57 per cent. of the appendices. Of the 45 acute cases the colon bacillus, alone or mixed, is present in 53 per cent. No other single bacterium appears in any large number of cases. Eighteen appendices gave no cultural growth. The two infected wounds of 36 acute cases closed without drainage (giving 5.5 per cent. infections); each showed the colon bacillus.

Of the 131 cases, 113, or 86 per cent., gave some form of growth; 122 were closed without drainage. Primary union was obtained in 117 (96 per cent.). Two hæmatomas, both sterile, appeared; one in a chronic appendix case, the other in a prophylactic appendectomy. One abscess of the parietes appeared in a prophylactic appendectomy. The culture showed staphylococcus albus, probably a skin contamination. Two of the acute cases developed a parietal abscess on the seventh post-operative day.

CONCLUSIONS

The appendix is potentially an infecting agent even when the most careful technic is used. Too much care cannot be exercised in delivering and removing it. Occasional parietal and deep-seated infections will occur under the most approved technic.

My most grateful thanks are due to Doctor Gibson for the privilege of operating upon and reporting these cases and to Doctor Wieden of the House Staff for aid in preparing the data.

CULTURES FROM THE APPENDIX

Dr. Chas. E. Parr 131 Cases		
Chronic appendix. Primary union.....	17	Gram neg. bacillus of colon group
Chronic appendix. Hematoma of wound..	1	Same + Gram positive cocci
Prophylactic appendectomy. Primary union.....	14	Same + diphtheroid bacillus
Prophylactic appendectomy. Hematoma of wound or abscess of wound.....	13	Same + staphylococcus albus
Acute appendix. Primary union.....	3	Same + staphylococcus aureus
Acute appendix. Drained wounds.....	2	Same + non-hemolytic streptococcus
Acute appendix. Seventh-day infections..	2	Bacillus coli communis
Total.....	50	Same + staphylococcus aureus bac. proteus
	1	Same + bac. lactis aërogenes
	2	Same + staphylococcus albus
	1	Bacillus coli communior
	4	Staphylococcus aureus
	4	Same + non-hemolytic streptococcus
	1	Diphtheroid bacillus
	9	Bacillus pyocyaneus
	2	Staphylococcus albus
	7	Same + diphtheroid bacillus
	1	Gram neg. bacillus producing no gas and fermenting no sugar (contaminated)
	1	Bacillus alkaligenes
	4	Bacillus proteus
	3	Contaminated with bacillus subtilis
	4	Contaminated
	2	No growth
	16	Total
	131	

RESULTS OF TREATMENT OF TWENTY RECENT CASES OF
INTRACAPSULAR FRACTURE OF THE FEMUR BY
ABDUCTION AND PLASTER FIXATION*

BY EUGENE C. MURPHY, M.D.

AND

GEORGE M. DORRANCE, M.D.

OF PHILADELPHIA, PA.

(From the Surgical Service of St. Agnes Hospital)

IN THIS statistical report we have included all cases regardless of previous treatment. One case had been treated four weeks by the Buck's extension treatment before we placed her in a cast, but, nevertheless, we include it in this report. No case was considered too ill for this form of treatment, as is evidenced by two cases. One had cardiorenal disease and was too ill for an anæsthetic. A cast was applied and the patient died five days later of a broncho-pneumonia. The other case was a patient of eighty years, who at the time of admission was in a semiconscious condition; a cast was applied and she died five days later of hypostatic pneumonia. These are the only two cases that died out of the twenty treated by our method.

The age of the patients treated is a very important point to consider. One patient of thirty-seven and another of fifty years are the youngest we have on our list, the other eighteen ranging from sixty to eighty years of age.

The condition of these patients on admission to the hospital in most cases was such that it would make one stop to wonder if any form of treatment would be helpful to them, yet all cases were treated. Five of these patients had incontinence of urine and fæces on admission, and four of them recovered from this condition after application of the cast; one in nine days, another in seven days, and two in five days. Six had decubitus on admission, and after application of the cast and local treatment two of them were cured in four days, two in eight days, one in ten days, and one in twelve days. No cases of decubitus developed while in the cast, because of the ease with which these patients can be handled. The same may be said of lung complications, for the patient can be placed in a wheeling chair without any difficulty.

On admission it was impossible to move the patients without causing pain and shock. They refused nourishment, were depressed, and continually complained, but after application of the cast there seemed to be a marked change. They became cheerful, very easy to lift, quite sociable and showed a marked improvement in appetite. Instead of developing

* Read before the Philadelphia Academy of Surgery, February 7, 1921.

INTRACAPSULAR FRACTURE OF THE FEMUR

decubitus, that already formed showed marked improvement. It has never been necessary to remove a cast because of any complaints from the patient. Two patients had umbilical herniæ, and three had inguinal herniæ, but they suffered no inconvenience from the cast.

One of the most interesting points brought out in this tabulation of cases is the X-ray report of pictures taken of the fracture after removal of the cast. All but two showed a dense fibrous union, although, clinically, all but one seems to have permanent osseous union. The two cases which show osseous union are the two youngest on the list—the one of fifty years and the other of thirty-seven. Another point of interest to be noted is that of the twenty cases, eighteen are females. We have no explanation to offer, excepting that the female pelvis is slightly broader and that the bones of the female are slighter than the male.

The final results of these cases show that nine have full function restored, eight cases have slight impairment of function, but all are capable of walking about. Five use a cane. One case has complete absorption of the neck of the femur and a shortening of two and three-quarters inches and requires an elevation of the sole of her shoe which enables her to walk with the aid of a cane.

We do not expect osseous union in any case over sixty-five years of age, but good functional results are to be obtained.

Any statistical review of intracapsular fracture without a detailed history of each case is difficult to analyze, for we know that many of our cases were very unfavorable subjects for any form of treatment. We are satisfied with the results obtained in these cases and feel that any patient who has not obtained a good result would have had less chance with bone-plating, pegging, and the other forms of treatment.

It is to be noted that we are discussing recent cases and not old ununited fractures with absorption.

MURPHY AND DORRANCE

No.	Patient	Age	Sex	Date of admission	Date of discharge	Shortening on admission	Number of days before application of cast	Length of time cast remained on patient	Incontinence of urine and feces after application of cast	Bed-sores	Union as shown by X-ray	Position as shown by X-ray	Amount of shortening after removal of cast
1	A. F.....	80	F	1/20/16	3/2/16	1 1/2 inches	7 days	13 weeks	9 days	None	Dense fibrous	Fair	1 inch
2	C. M.....	75	F	1/23/16	4/19/16	1 inch	4 days	13 weeks	.....	8 days	Fibrous	Fair	3/4 inch
3	M. McG..	73	F	12/16/15	4/10/16	1 1/4 inches	3 days	13 weeks	.....	.....	Fibrous	Fair	1/2 inch
4	M. C.....	65	F	12/15/15	4/5/16	1 inch	2 days	13 weeks	.....	.....	Fibrous	Fair	1/2 inch
5	E. D.....	64	F	2/24/16	4/10/16	3/4 inch	2 days	13 weeks	.....	4 days	Dense fibrous	Fair	1/2 inch
6	A. D.....	71	F	12/30/19	5/1/20	1 1/2 inches	3 days	13 weeks	5 days	8 days	Fibrous	Fair	1/2 inch
7	A. D.....	60	F	3/30/20	7/9/20	1 inch	2 days	13 weeks	.....	.....	Fibrous	Good	1/2 inch
8	L. M.....	69	F	10/16/19	3/25/20	3 inches	3 days	14 weeks	.....	.....	Fibrous	Poor	2 1/4 inches
9	C. McC...	50	F	1/10/20	4/18/20	1 inch	3 days	13 weeks	.....	.....	Oseous	Good	.....
10	A. S.....	65	F	11/10/20	Still in hospital	1 1/2 inches	4 days	17 weeks	5 days	10 days	Dense fibrous	Fair	3/4 inch
11	J. T.....	37	M	2/10/20	5/30/20	1 1/4 inches	3 days	13 weeks	.....	.....	Oseous	Good	1/4 inch
12	M. D.....	70	F	12/25/19	Died	1 1/2 inches	.....	.....	.....	.....	.....	.....	.....
13	M. M.....	70	F	1/9/16	4/18/16	1 1/2 inches	4 days	13 weeks	7 days	12 days	Dense fibrous	Fair	1 inch
14	A. A.....	80	F	4/23/17	Died	1 1/4 inches	2 days	.....	5 days	.....	.....	.....	.....
15	M. B.....	76	F	10/13/17	4/28/17	1 inch	4 weeks	10 weeks	.....	.....	Fibrous	Fair	1/4 inch
16	J. M.....	70	F	3/1/15	2/12/18	1 inch	4 days	12 weeks	.....	.....	Fibrous	Good	1/2 inch
17	L. F.....	64	F	8/29/17	6/18/15	1 inch	7 days	13 weeks	.....	4 days	Fibrous	Good	1/4 inch
18	S. F.....	60	F	2/2/17	12/24/17	1 inch	2 days	13 weeks	.....	.....	Fibrous	Good	1/4 inch
19	S. M. G...	62	F	12/21/17	5/5/17	3/4 inch	3 days	13 weeks	.....	.....	Fibrous	Good	.....
20	W. G.....	77	M	8/29/17	3/1/18	1 inch	4 days	13 weeks	.....	.....	Fibrous	Good	1/2 inch

Results

- No. 1. Patient walks, function good.
 No. 2. Patient walks, slight limp.
 No. 3. Patient walks, full function.
 No. 4. Patient walks, slight limp.
 No. 5. Patient walks, slight limp.
 No. 6. Patient walks, slight limp.
 No. 7. Patient walks with limp.
 No. 8. Excellent, full function.
 No. 9. Absorption of neck of femur, requires a built-up shoe.
 No. 10. Excellent, full function.
 No. 11. Up to present time, excellent.
 No. 12. Excellent, full function.
 No. 13. Died of pneumonia (cardiorenal disease).
 No. 14. Patient walks with limp.
 No. 15. Patient died of pneumonia.
 No. 16. Slight limp, walks with a cane.
 No. 17. Full function.
 No. 18. Full function.
 No. 19. Full function.
 No. 20. Full function.

CANCER OF THE LARGE INTESTINE *

NOT INCLUDING THE RECTUM AND RECTOSIGMOID

By JAMES I. RUSSELL, M.D.

OF NEW YORK, N. Y.

IN reviewing the cancerous growths of the large intestine, not including the rectum and rectosigmoid, occurring in the Surgical Service at the Roosevelt Hospital during the past six years—1915 to 1920 inclusive—there were forty-seven cases admitted into the service, forty-two of whom were operated; the other five either declined operation or were considered inoperable for various reasons: debility, cachexia and so forth, with non-obstructive conditions at the time of examination.

During this same period there were 17,527 operations performed, fifty-five of which were for cancer of the rectum and rectosigmoid, which are not included in this report but confirm the fact, though the series is a small one, that carcinoma of the rectum and rectosigmoid is much more frequent than in the entire large intestine from the ileocecal valve to the rectosigmoid juncture. As with cancer appearing in other parts of the human body, cancer of the big gut is a condition of later life, though it may occur at almost any age; our oldest patient being seventy-eight years, the youngest twenty-one years. The former was suffering from acute ileus at the time of his admission into the hospital, his condition was extremely grave, an immediate enterostomy was done, followed by death four hours later. The youngest, a woman of twenty-one years, had a perforated carcinoma of the cæcum with extensive peritonitis at the time of admission; abdominal and vaginal drainage were immediately instituted, at which time the cause of the peritonitis was undetermined. A second operation a few days later disclosed a perforated cancer of the cæcum. She died eight days after the first operation.

Cancer of the large intestine was about equally common in the two sexes, there being twenty-four men and twenty-three women. The first signals in the great majority were of gradual onset of which the most frequent were pain and constipation. The onset, however, may be of an alarmingly short duration; two-days is our shortest time and two years our longest. The average duration of symptoms until admission into the hospital was about six months.

Given the age of the patient and a carefully elicited history, with undivided attention to the symptoms and the sequence in which they appear, aided by a careful physical examination and the X-ray findings, it would seem that a correct diagnosis should be reached at a much earlier time. Yet, on the other hand, we know that a cancerous growth, and

* Read before the New York Surgical Society, April 27, 1921.

especially in the cæcum where the obstructive symptoms may be long delayed, can reach a considerable size and not infrequently be observed by the patient before the surgeon is even consulted.

It is commonly pain, more or less persistent, but usually recurring in attacks with increasing frequency, constipation becoming more aggravated (only relieved by catharsis, and this in increasing doses and strength), blood in the stools, or possibly a mass discovered by the patient himself, that prompts the patient to seek advice for relief of his condition. Pain was the most frequent symptom complained of in thirty-six of our cases; constipation, varying from mild constipation to complete obstipation, the next most prominent symptom in thirty of them. Distention, vomiting, loss of strength and loss of weight occurred with about equal frequency in seventeen of them. Hemorrhage from the bowel observed by the patient occurred in one-fourth of the forty-seven cases, *i.e.*, twelve complained of this symptom. Five complained of diarrhœa and two of epigastric distress.

Tenderness in variable degrees was present in a very large percentage of the cases. A stiffening of the proximal segment of the gut under the palpating hand is a very constant symptom and a valuable aid in diagnosis; as is visible peristalsis if present. A palpable mass was present in over half of our cases, *i.e.*, in twenty-six of them. The X-ray gave positive information in locating the growth and the extent of the constriction of the lumen of the gut in the eighteen cases in which it was taken.

In twenty-three of the patients the growth was located in the cæcum and ascending colon. In seventeen it was located in the splenic flexure, descending and sigmoid colon; and in the remaining seven in the transverse colon; which distribution gives a very high percentage in the right half of the colon and one that we feel would undoubtedly be different in a larger series of cases.

There were seven cases of acute ileus which demanded immediate operation, four of which died—three within thirty-six hours after operation and one eight days after operation. A cæcostomy was done in three cases and enterostomy in one, and one other in which cæcostomy was done survived but was in poor condition at the time of leaving the hospital. The two-stage Mikulicz operation was done twice in movable sigmoid growths; both survived, are living and apparently well to-day, eighteen months after operation. Much can be accomplished where this operation can be applied, as the growth can be everted and the obstruction can be relieved at the same time by a very quick and simple operation.

Since diverticulitis and carcinoma of the large intestine both occur most frequently after middle life, it is not unusual to confuse the diagnosis of perforated diverticulitis with perforation of a cancerous growth. Both may be insidious and gradual in onset, with the development of a tender and painful mass, rise in the temperature curve, and a distinct increase in the leucocyte and polymorphonuclear count; or the onset

CANCER OF THE LARGE INTESTINE

may be sudden, presenting the classical picture of a perforated hollow viscus.

Perforation had occurred in five of the cases at the time of admission, twice in the sigmoid and once in the descending colon; in each of which the pre-operative diagnosis was supposed to be an abscess from a perforated diverticulitis. All were drained, followed by radical operation later; one survived the second operation and was in good condition when last seen. In two the perforation was in the cæcum, both died, one in thirty-six hours and the other in eight days.

The microscopical diagnosis in all cases reported upon was that of adenocarcinoma; the adjacent mesenteric lymph-nodes were carcinomatous five times and hypertrophic several times, but showing no carcinomatous changes.

Primary resection with end-to-end, lateral or end-to-side anastomosis was done fifteen times with three deaths, a mortality of 20 per cent. The two-stage operation was done nine times, seven of which were of the Mikulicz type; in two a colostomy was done followed by excision with lateral anastomosis. There was one death, a mortality of 11 per cent. Permanent colostomy was done three times with no deaths; cæcostomy five times with four deaths. Six inoperable growths were explored, in four of which an anastomosis was done around the growth.

The average number of hospital days in the primary radical operation was thirty-two days; in the two-stage radical operation it was seventy-three days. Nineteen of the patients have been traced to the present writing, seven of whom have died:

One died six years after operation; one died three years after operation; one died two years after operation; one died one and one-half years after operation; three died four months after operation.

One is living six years after operation; one is living three years after operation; one is living two years after operation; one is living one and one-half years after operation; six are living one year after operation; two are living eight years after operation.

A SHORT ABSTRACT OF THE CASES LIVING

CASE I (B 5844).—Living six years post operation. Had palpable mass in ascending colon. X-ray not taken. Enterocolectomy with lateral anastomosis. Pathological report: Adenocarcinoma.

CASE II (A 14317).—Living three years post operation. Mass not felt before operation. Annular growth of the transverse colon. No X-ray taken. Two-stage Mikulicz operation. Pathological report: Adenocarcinoma.

CASE III (B 11867).—Living eighteen months post operation. Has gained considerable weight; is doing full-time work and feels perfectly well. Mass felt in left lower quadrant. X-ray positive. Partial colectomy of the descending colon with end-to-end anastomosis. Pathological report: Adenocarcinoma; metastasis not stated.

CASE IV (A 15064).—Living two years post operation. Physical examination negative. No X-ray taken. Carcinoma of the sigmoid. Two-stage Mikulicz operation. Pathological report: Adenocarcinoma; metastasis not stated.

CASE V (A 16898).—Living one year post operation. No mass felt. X-ray positive. Carcinoma of the transverse colon. Two-stage Mikulicz operation. Pathological report: Adenocarcinoma; gland metastasis.

CASE VI (A 16702).—Living one year post operation. No mass felt. No X-ray taken. Was a case of acute obstruction; immediate operation. Growth in the sigmoid. Two-stage Mikulicz operation. Pathological report: Adenocarcinoma with gland metastasis.

CASE VII (B 12471).—Living one year post operation. No mass felt. No X-ray taken. Carcinoma of the sigmoid. Partial colectomy with end-to-end anastomosis. Pathological report: Adenocarcinoma; no gland metastasis.

CASE VIII (B 12881).—Living one year post operation. Mass felt in right lower quadrant. X-ray positive. Carcinoma of the cæcum. Enterocolectomy with end-to-end anastomosis. Pathological report: Adenocarcinoma; gland hypertrophy; no metastasis.

CASE IX (B 12696).—Living one year post operation. Acute obstruction at the time of admission. No mass felt. No X-ray taken. Immediate operation. Growth in the sigmoid. Two-stage Mikulicz operation. Pathological report: Adenocarcinoma. Gland metastasis not stated.

CASE X (A 16381).—Living one year. No mass palpable. X-ray positive. Refused operation. Is still living. Condition poor.

CASE XI (B 13153).—Living eight months post operation. Mass in right upper quadrant. X-ray positive. Carcinoma of the hepatic flexure. Enterocolectomy with lateral anastomosis. Has gained thirty pounds and feels perfectly well. Pathological report: Adenocarcinoma with gland metastasis.

CASE XII (B 13605).—Living eight months. Incomplete obstruction. No mass felt. X-ray not taken. Growth in the transverse colon. Colocolectomy with lateral anastomosis. Pathological report: Adenocarcinoma with gland metastasis.

Our total mortality of 28.7 per cent. in all cases operated upon seems very high, but is accounted for in some degree by the extremely grave condition in which a large number of the patients were at the time of their entrance into the hospital.

There were seven cases of acute ileus, five of which were utterly hopeless. It would seem that the aforesaid mortality should be classed as a cancer rather than an operative mortality, since there were twenty-four radical operations with but four deaths, a mortality of 16.6 per cent. Hence, it is rather the graveness of the condition of the patient than the magnitude of the operation upon which the mortality depends.

CANCER OF THE LARGE INTESTINE

It should be proved in all cases of suppurative diverticulitis that the perforation is not of cancer origin.

Radical excision in the presence of any considerable degree of obstruction, though it be slight, is a dangerous procedure accompanied by a high mortality. A preliminary colostomy or the Mikulicz operation, where feasible, is a far safer and wiser procedure. Where there is no obstruction nor marked dilatation of the proximal segment the choice between the primary radical and the two-stage operation will depend upon many factors: the condition of the patient at the time of operation, whether he be fat or thin, the location and the mobility of the growth, etc., and the choice of the individual operator. It would seem from our series that primary radical excision in properly selected cases was the method of choice. Whether the anastomosis be lateral, end-to-side, end-to-end, or the Balfour modification of the end-to-end by the aid of a tube, etc., be done, are considerations that vary in the opinions of the different operators. There is, however, a marked tendency among some surgeons at the present time to show preference for the end-to-end anastomosis between the small and the large intestine as well as end-to-end anastomosis in the large intestine. The Mikulicz operation has a very important field, since it can be rapidly done and is a safer procedure in the hands of many surgeons with the added advantage of being applicable in acute ileus, and especially when the growth is located in the sigmoid.

An anastomosis around an inoperable growth will probably prolong life, is preferable and far more acceptable to the patient than a permanent colostomy, which should be deferred as long as possible in inoperable and obstructive conditions.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting held February 7, 1921

The President, DR. GEORGE G. ROSS, in the Chair

FRACTURES OF THE JAW

DR. GEORGE M. DORRANCE presented patients to illustrate methods of treating fractures of the mandible. In the first case, a fracture in the right canine region, the fragments were held in place by an interdental splint. Such a splint is indicated when there is a single fracture anterior to the second bicuspid in which the teeth are present. At times it may be used further back. It has the advantage that no external bandaging is necessary, and the patient can open his mouth to talk, swallow, etc.

Case II was a case of multiple fracture in which the fragments were held in place by intermaxillary splints which were soldered in place. This is the ideal splint, and is especially applicable in such cases. The advantage of the splints is that as soon as the fracture has been reduced and the splints applied, the treatment is practically finished, and it is only necessary for the patient to return for treatment about once a week. Whereas in cases where wiring is used, it is necessary to see the patient every few days.

Case III, a fracture of the body of the mandible at the canine tooth, was treated by intermaxillary wiring. This is an excellent method.

DR. ROBERT H. IVY remarked that the chief difficulty about interdental splints is to have them made. Ordinarily it takes a man two full days to make a splint, and the men who know how to make them are very few. Very often it is two weeks or longer before a splint is ready for use. Intermaxillary wiring was available while waiting for the splint, or might be used throughout the treatment. In twelve or fifteen cases which he had treated this winter he had seen only one in which the maxillary wiring was not adequate. In some cases no fixation is necessary at all.

DOCTOR DORRANCE rejoined that in the intermaxillary or the interdental splints when applied in cases which are suitable to each, the treatment of holding the fragments in position is practically finished. The wiring of the lower to the upper teeth will give satisfactory results, but requires continuous retightening of the wires from time to time. The splints, in other words, are the most refined and accurate method of fractures of the mandible.

INTERNAL DERANGEMENTS OF JOINTS

BROKEN NECK

DR. HENRY P. BROWN presented a man whose case was reported by him at the December meeting of this society, while the patient was still in the Pennsylvania Hospital. He is a man who sustained a fracture of the atlas and axis in falling during an attack of epilepsy. He wore a jury-mast extension for six weeks while in bed, and was then allowed out of bed with a plaster collar, and now wears a reinforced leather collar which supports the weight of his head on his shoulders. He has limitation of motion, especially in turning the head to the right; flexion and extension is about twenty degrees in each direction. He still has pain on making pressure over the atlas and axis on the right side of his neck, posterior. At no time has he shown symptoms of nerve involvement, as indicated by paralysis or anæsthesia. He asked whether Doctor Rugh still thought that a bone-graft operation is indicated in this case.

DR. J. TORRANCE RUGH replied that since the man had made a good recovery and has no symptoms he saw no occasion for interference. The time for operation is early when there are nerve symptoms, pains, and instability. Then he would not hesitate to place a bone graft.

SNAPPING JAW

DR. ASTLEY P. C. ASHHURST reported a case of recurrent unilateral subluxation of the mandible cured by excision of the interarticular cartilage, for which see page 712.

INTERNAL DERANGEMENTS OF JOINTS

DOCTOR ASHHURST also presented the following patients:

I. Loose Cartilage in the Elbow-joint.—Charles S., aged twenty years, was admitted to the Episcopal Hospital, September 14, 1920, referred by Doctor Levering. He had injured his right elbow in a fall more than three years previously, and a certain amount of disability had persisted since. His chief complaint was "inability to bend the elbow at times," and always there was pain on complete extension.

Examination showed nothing but tenderness at tip of olecranon in forced extension. Flexion was normal. A skiagraph, however, showed a loose cartilaginous body in the olecranon fossa.

Operation (September 17, 1920).—Longitudinal incision 7 cm. in length was made, splitting the triceps from the olecranon up. The loose cartilage (Fig. 1) was found occupying the olecranon fossa; it measured 1.5 x 1.25 x 1 cm. It was entirely unattached, but caught beneath the thickened posterior capsule. It was easily removed, and the wound was closed in layers. A splint was worn for a few days, when active use of the arm was allowed. Full function rapidly returned. He now has no disability whatever, and full flexion and extension.

II. *Recurrent Dislocation of the Internal Semilunar Cartilage in the Knee-joint.*—M. W., aged twenty-five years, was admitted to the Episcopal Hospital, December 18, 1920, with the history that in 1918 while playing base ball he "dislocated" his right knee; it was "reduced" on the field. Since then he has had five dislocations and has always been able to reduce them himself, until the present occasion (December 17, 1920), when he tripped over a line about three inches from the floor where he was working, and landed on the right foot; as a result his right knee locked and has been locked ever since the accident.

Examination.—The right knee is locked in flexion about 150 degrees. Can flex it slightly, but extension and external rotation cause pain. Internal rotation does not cause pain.

Operation (December 24, 1920).—Longitudinal section of patella, splitting also ligamentum mucosum which was found already detached from the intercondylar groove, and exposing a fractured internal semilunar cartilage: the fracture was about 2 mm. from the anterior end of its tibial attachment, and the remainder of the cartilage was only loosely attached. Each fragment in turn was caught in a sharp tenaculum and excised. There was granulation tissue in the intercondylar notch, an evidence of long-standing arthritis. Structures were closed in layers and a posterior splint applied for the first few days. January 7, 1921.—On crutches. January 19, 1921.—Without crutches. January 25, 1921.—Discharged. Flexion to 150 degrees. His knee now flexes to 120 degrees and is painless. (When seen in March, 1921, flexion was possible to 90 degrees and was still improving. No disability.)

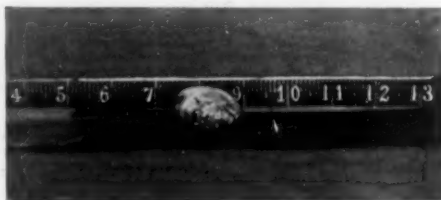


FIG. 1.—Case I. Loose cartilage in the elbow-joint. Scale in centimetres.

III. *Arthrotomy for Multiple Intraarticular Exostoses in the Knee-joint, Following Suppurative Arthritis.*—A. W., male, a native of Cuba, was twenty-eight years of age when he came to the Episcopal Hospital in October, 1915. In 1910 while employed in the Panama Canal Zone he developed an acute arthritis of the left knee, following some injury. He was taken to a hospital, and two days later an operation was done, tubes being used to drain the joint. It was thought he would die. Later weight extension was applied. He was in bed four months in the hospital, and used crutches for six months after his discharge.

His chief complaint when he came to the Episcopal Hospital was that he could not run, and that he could not stand long or do any hard work. He worked in a cigar factory. There was creaking on motion in the knee, and the range of motion was limited (95 to 165 degrees only). The patella could scarcely be moved on the condyles. The stability of the joint, as regards lateral motion,

INTERNAL DERANGEMENTS OF JOINTS

was good. X-rays (Figs. 2 and 3) showed large masses of intraarticular new-formed bone, which evidently were the cause of the limited motion.

Operation (October 6, 1915).—Longitudinal section of the patella, the quadriceps tendon and the patellar tendon. It was very difficult to reflect the two halves of the patella because of bony masses at its lower border, not adherent by bone to the patella, but seemingly embedded in cartilage and fibrous tissue only. It proved difficult to excise these masses, but when once this was done, it was easy to reflect the halves of the patella, freely exposing the condyles. An exostosis the size of a plum arose from the external condyle,



FIG. 2.—Case III. Cartilaginous exostoses within the knee-joint.

and was excised. There was marked lipping at the upper anterior border of the condyles at the margins of the articular cartilage. The patella was concave on its lower surface, and lipped on all its borders. As these lips were well covered with fibrous tissue they were not removed. The wound was closed in layers, and the limb dressed on a splint. Operative recovery was uneventful.

December 15, 1915.—About ten weeks after operation, as the range of motion was still limited (165 to 180 degrees), the knee was forcibly flexed under nitrous oxide anaesthesia, a free range of motion from 110 to 180 degrees being secured.

PHILADELPHIA ACADEMY OF SURGERY

February 28, 1916.—It was noted that the range of motion was 105 to 180 degrees.

June 18, 1919.—Motion 80 to 180 degrees. Can "run" now whenever he wants to. The patella feels normal, the scar is soft and supple, and though there is marked crackling on motion, and he says that if he works hard the knee swells and pains some, yet



FIG. 3.—Case III. Cartilaginous exostoses within the knee-joint.

he is entirely satisfied with the result and has very much less disability than before operation.

February 7, 1921.—His condition remains as at the last inspection, June, 1919.

DR. J. TORRANCE RUGH reported the removal of a cartilaginous body from outside the head of the radius at the elbow under local anæsthesia. The X-ray had failed to show anything and the case looked like one of tuberculosis. There was a history of injury of two years' standing. In examining the patient, however, he felt something slip under his finger, and then realized that he had a foreign body in a joint to deal with. The foreign body was readily removed.

DR. T. TURNER THOMAS said that some years ago he had a patient who

INTESTINAL OBSTRUCTION

could demonstrate to him that he had a foreign body in one of his knees. He said he had the same thing in the other knee. The doctor operated on the side where he could locate the foreign body and removed it. Because the man insisted that the same condition existed on the other side, he made two large lateral incisions and thoroughly explored this joint, but nothing was found and the two incisions were closed. He has never had any trouble in either knee since, and that was eight or ten years ago. We concluded that there was probably a loose cartilage in this other knee, that the contraction of the capsular ligament to which the cartilage is intimately attached, from the operation was enough to prevent dislocation of the cartilage.

INTESTINAL OBSTRUCTION CAUSED BY BAND FROM MECKEL'S DIVERTICULUM

DRS. EDWARD T. CROSSAN and (by invitation) DON G. LEW reported the history of a man, aged nineteen years, who was admitted 10.30 P.M., January 20, 1921, to the service of Dr. A. P. C. Ashhurst at the Episcopal Hospital. His chief complaint was pains in the right lower abdomen, which began five and a half hours before admission to the hospital. The patient was not nauseated and had not vomited. Has had a history of three previous attacks, the first one eight months ago, the second one five months ago, and the third one six days ago; each of these attacks was accompanied by vomiting and with only one day's duration, disappearing after a laxative.

He appeared to be in great pain and acutely ill. The abdomen was not distended, no bulging any place in the anterior abdominal wall.

Peristalsis audible but not increased. The right lower abdomen was rigid and extremely tender. Umbilicus abnormal, shaped like a small doughnut, being much elevated all around the periphery and depressed in the centre, three cm. in diameter. The remainder of the physical examination was negative. White blood count, 15,400. Urine showed a faint trace of albumin and occasional hyaline and light granular cast.

Doctors Crossan and Lew operated upon the patient, a Davis transverse incision being made and the appendix removed; the appendix was kinked in one place and congested, and on opening blood was found in the lumen and a small faecolith at the tip. The caecum and ileum showed

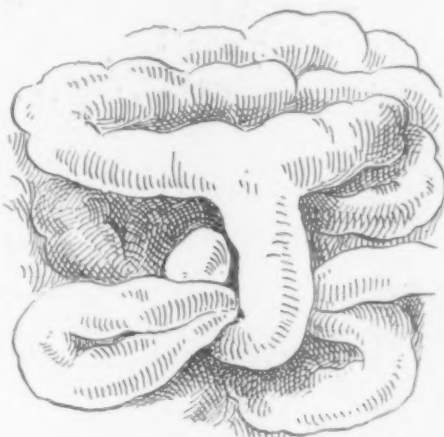


FIG. 4.—Diagram to show how a loop of small intestine was strangulated inside a loop formed by an adherent Meckel's diverticulum.

nothing abnormal at operation. The finger was introduced and swept around the anterior wall in region of the umbilicus, suspecting Meckel's diverticulum because of the queer-shaped umbilicus. Nothing was encountered and the patient was sewed up.

The next morning, January 21, 1921, patient said he had some pain still and vomited once for the first time. About 2.00 P.M. the patient had stercoraceous vomiting.

At 4.30 P.M. Doctor Ashhurst saw the patient and, recognizing the

acute intestinal obstruction, immediately reopened the abdomen under gas. A long, black coil of intestine prolapsed on opening the peritoneum; small intestines were distended and injected; sigmoid collapsed, containing scybalous masses; cæcum and end of ileum collapsed; an adherent mass in the pelvis delivered and found to be a Meckel's diverticulum, strangulating a mass of small intestines by an appendix-like structure adherent to the end of diverticulum about 1 x 6 cm., and attached to the pelvis (Fig. 4). The diverticulum was a pouch the size of a large hen's egg, wider at the base, springing from the anterior part of



FIG. 5.—Specimen of Meckel's diverticulum. The ileum is seen running transversely above the large dependent diverticulum; into the fundus of this diverticulum a Paul's tube was sewn at operation (enterostomy). At the left of the diverticulum is shown the fibrous band which was adherent to the parietal peritoneum and completed the circle in which a neighboring coil of ileum became strangulated as indicated in the small sketch (Fig. 4).

the bowel opposite the mesenteric border (Fig. 5). The adhesions were divided and the prolapsed bowel was reduced by towel manœuvre and a Paul's tube sutured into the apex of the diverticulum. The patient's condition was poor following the operation. He grew steadily worse and died about forty-eight hours after the operation, apparent cause of death being toxæmia from paresis of the bowel and uræmia.

Post-mortem examination revealed nothing new outside of distended and congested bowels and congested kidneys. No peritonitis.

INTRACAPSULAR FRACTURE OF THE NECK OF THE FEMUR

TREATMENT OF INTRACAPSULAR FRACTURE OF THE NECK OF THE FEMUR

DR. EUGENE C. MURPHY and DR. GEORGE M. DORRANCE presented a paper with the above title, for which see page 752.

DR. A. P. C. ASHHURST said it should be well to recognize that no method is infallible always. He had one patient in the Episcopal Hospital, a woman about fifty years of age, in whom he reduced the intracapsular fracture to the best of his ability by abduction, and treated her in an abduction case for the usual time, but on removal of the case the fracture simply fell apart, there being no union at all. This was corrected by implanting a bone peg.

In his opinion some of the skiagraphs shown in illustration of Doctors Murphy and Dorrance's paper are certainly not intracapsular fractures. At least one X-ray shown is clearly a "fracture through the trochanters."

DR. T. TURNER THOMAS said that in a former discussion of this subject he heard one surgeon in criticising this treatment say that it was cruel to put these old people in a plaster case. On that occasion Whitman argued that the case made for increased comfort, which opinion Doctor Thomas thought to be correct. Last summer he had a man over sixty with a fracture of the femur and an amputation of the thigh on the other side. He put an abduction case on him and an ordinary wood screw through both fragments, taking full weight on the fractured limb, with good motion in the hip-joint. He is now able to go about on crutches and his foot seems to be in good position.

DR. GEORGE M. DORRANCE said that some of these cases came to them almost moribund. After they were put in abduction plaster cases, it was surprising to see the difference. The case should be applied as soon as possible after the accident. They have been breaking up impactions, although not sure that it is best to do so. Seventeen to eighteen weeks is about the right time that these patients should be kept in the case. They should not walk for four or five weeks thereafter. There is firm fibrous union in these old people in from fourteen to fifteen weeks.

INTRACAPSULAR FRACTURE OF THE NECK OF THE FEMUR

DOCTOR ASHHURST reported the following case: Susan B., aged eighty-one years, was admitted to the Episcopal Hospital, April 21, 1920, one week after a fall down some steps in which she had injured her *right* hip. Skiagraphs (Doctor Bromer) showed "fracture of the neck of the femur with impaction; this also involves the great trochanter" (Fig. 6.)

The day after admission, April 22, 1920, under nitrous oxide anaesthesia, Doctor Ashhurst forcibly abducted the *right* hip and rotated it in, to secure permanent impaction; a plaster-of-Paris dressing was applied from axillæ to the toes. Bed-sores were present over the sacrum and the *left* heel.



FIG. 7.—Intracapsular fracture of the neck of femur after ten weeks in abduction cast.

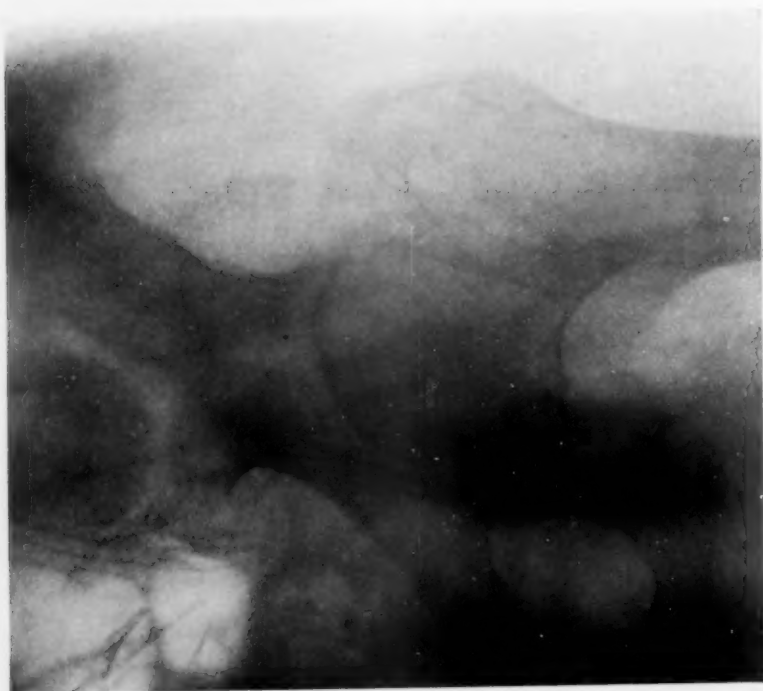


FIG. 6.—Intracapsular fracture of neck of right femur; skiagraph made April 22, 1920, on admission to hospital, one week after injury. Age, eighty-one years.

INTRACAPSULAR FRACTURE OF THE NECK OF THE FEMUR



FIG. 8.—Specimen of ununited fracture of the neck of the right femur (intracapsular) secured nine months after injury, in a woman eighty-one years of age. The apparent impaction of the recent fracture is shown in Fig. 6, and the apparent union after treatment in an abduction cast is shown in Fig. 7.



FIG. 9.—Skullagraph of post-mortem specimen of an intracapsular fracture of the neck of the femur. See also Figs. 6, 7, 8.

PHILADELPHIA ACADEMY OF SURGERY

June 21, 1920.—The sacral bed-sores had healed; that over the left heel is granulating slowly. X-ray, "the old line of fracture can scarcely be seen; while there is considerable rarefaction there appears to be fair union" (Fig. 7). The case was removed piecemeal, from eight to ten weeks after the reduction.

August 15, 1920.—Up and about in chair. August 20th.—Learning to walk. August 24th.—Can raise right lower extremity off bed when lying on back, and flex hip and knee each about 30 degrees from full extension. Passive flexion of hip to 135 degrees and of knee almost to 90 degrees.

October.—Was able to walk entire length of ward (90 feet) with support. December.—Gradually weakening—confined to bed. January 2, 1921.—Died of asthenia.

The specimen, removed post mortem (Figs. 8 and 9), shows marked deformity as compared with the skiagraphic picture made after union was supposed to have been secured: the neck is almost wholly absorbed, the shaft fragment has ascended until the lesser trochanter catches on the head, and there is only fibrous union present. This indicates that (1) the original diagnosis of impacted fracture "at the base of the neck" was incorrect, the line of fracture being entirely intracapsular; (2) the fixation in abduction should have been continued much longer than eight or ten weeks; (3) walking should not have been permitted as soon as four months after injury. But in view of the patient's advanced age, and her comparative comfort under the method of treatment pursued, it is doubtful whether even if bony union had been secured, life would have been longer preserved.

DR. JOHN H. JOPSON showed the X-ray of the neck of a femur in a patient then under treatment. The patient was a young man aged thirty years. Four or five weeks ago while mounting his horse it fell and probably fell on him. He went back and forth to business in an automobile. At the end of three and one-half weeks he had X-ray pictures taken which showed a fracture through the middle of the neck of the femur, apparently without much deformity; undoubtedly there was some impaction. The man was put up in a plaster case from the lower thorax to the ankle. Recently Armitage, after a careful review of the condition and a careful study of the vascular supply, shows why we do not get union in elderly people. The blood supply in young life is rich; as the person advances in life the blood supply decreases. The reason healing does not occur in the advanced person is the presence of disease in the absence of a rich blood supply. We get the ideal result only in the exceptional case.

SPECIMENS OF FRACTURE OF THE VERTEBRAL COLUMN

DR. ASTLEY P. C. ASHHURST and (by invitation) DR. A. A. WALKLING presented the following specimens from the service of the former in the Episcopal Hospital:

SPECIMENS OF FRACTURE OF THE VERTEBRAL COLUMN

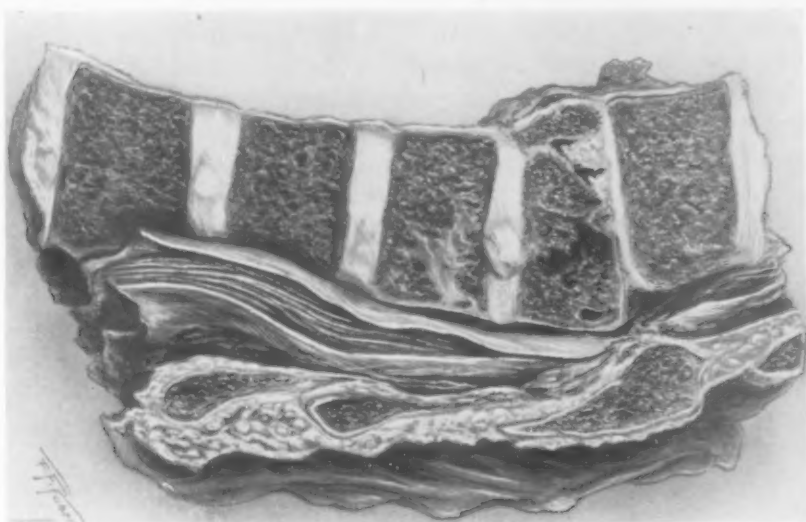


FIG. 10.—Specimen of fracture of the eleventh dorsal vertebra. Spinal cord crushed against the posterior upper margin of the eleventh. Removed at autopsy three and one-half months after injury.

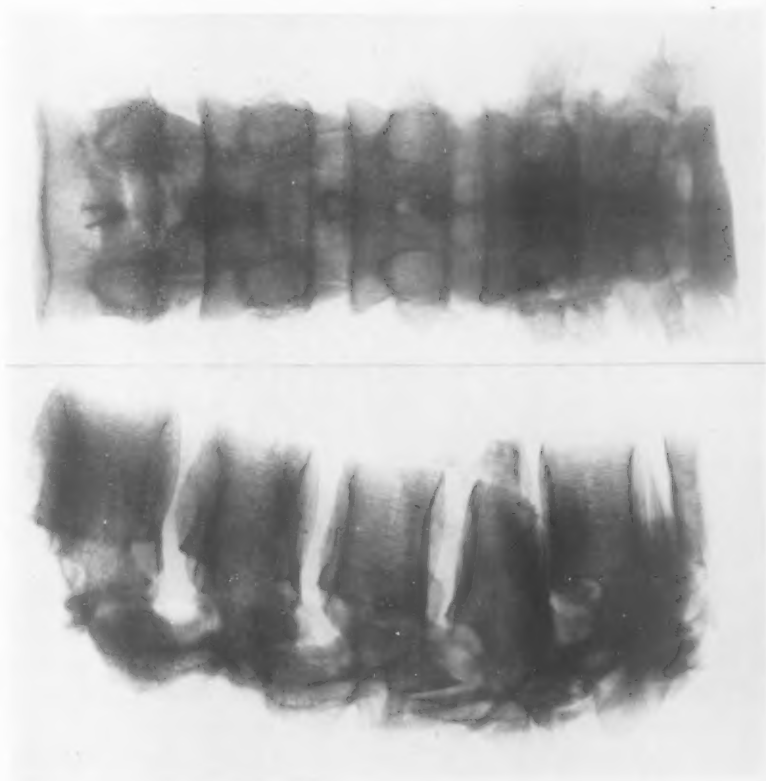


FIG. 11.—Skullgraph of the post-mortem specimen of fracture of the eleventh dorsal vertebra.

Jacob U., aged fifty years, admitted to Doctor Ashhurst's service in the Episcopal Hospital, October 12, 1920; died December 15, 1920. August 31, 1920, he fell about ten feet and landed on his back; was unconscious at first and on recovering consciousness found that he was paralyzed from the waist down. He was taken at once to a hospital in Springfield, Mass., where the accident occurred, and there a suprapubic cystotomy was done. He was brought to his home in Philadelphia to die.

Examination indicated a complete lesion of the spinal cord at the level of the eleventh or twelfth dorsal vertebra. A skiagraph (Dr. R. S. Bromer) showed fracture of the body of the eleventh dorsal vertebra, with forward displacement of the tenth. The bed-sores present on admission gradually improved; but early in December the patient developed fever, probably from infection of the kidneys and bladder; also a lymph-angitis of the right lower extremity. He gradually failed and died December 15, 1920, three months and a half after his injury.

This specimen (Fig. 10) was secured by Dr. A. A. Walkling, resident pathologist, at the autopsy, which also showed acute cystitis and ureteritis on the right; early pyonephrosis on the right, and chronic interstitial nephritis on the left.

The specimen shows clearly the forward displacement of the tenth dorsal, how the upper posterior border of the eleventh dorsal vertebra crushed the cord; it shows the triangular fragment of this vertebra broken off the upper anterior portion of its body, and the bony union which has occurred. Fig. 11 is from skiagraphs of the specimen.

FIBROMA OF THE OVARY

DOCTORS ASHHURST and WALKLING presented an ovarian tumor removed from a woman sixty-five years old who was admitted to the Episcopal Hospital December 7, 1920. Chief complaint—incontinence of urine for past three months, during which time she had had a dull aching pain in the right groin. Menopause at forty-nine years of age. Vaginal examination showed a large immovable mass posterior to uterus, filling entire true pelvis; cervix and uterus also almost immovable. Pre-operative diagnosis: Uterine fibroid, subperitoneal, impacted in pelvis.

Operation (December 10, 1920).—A fibroma of the ovary, firmly impacted in pelvis, was removed. Right tube removed with tumor. Left tube, seat of hydrosalpinx, also removed.

On the thirty-sixth day post-operative, up in chair—short of breath; back to bed. Four days later, up in chair again—no heart symptoms. Four days later, walking with nurse's aid—no symptoms. Two days later, January 26, 1921, she died suddenly while up and about the ward. Autopsy showed cause of death to be myocardial degeneration.

The specimen consists of a dense fibrous tumor measuring 12 x 6 x 4 cm. and weighing 170 grammes. (Fig. 12.) Microscopical examination: Fibroma.



FIG. 12.—Fibroma of ovary removed by laparotomy from a patient 65 years of age.



TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Regular Meeting held February 9, 1921

DR. WILLIAM A. DOWNES, President, in the Chair

BIRTH PALSY

DR. A. S. TAYLOR presented a child three years of age, who was first seen by him when an infant of five and one-half months. She was a vertex. Labor was difficult and instrumental. She weighed ten pounds. There was a swelling in the right side of the neck which disappeared in two weeks. On the second day it was noticed that the right arm did not move. On the tenth day the fingers began to move and there has been some further improvement since. She was healthy and normal except for the right upper extremity, which was in characteristic position by the side, elbow extended, humerus rotated inward, forearm fully pronated, wrist flexed forty-five degrees and ulna adducted. The digits could be moved with fair freedom. The wrist could be very slightly extended. No supination was possible. No flexion of the elbow was possible. There was no power of abduction or external rotation at the shoulder. The shoulder was dislocated posteriorly. The pectoralis major was rigidly contracted. The extremity as a whole could be moved forward about thirty-five degrees. It was smaller than the left extremity, and the muscles softer. A cicatrix is felt in the right plexus.

Operation (April 11, 1918).—C. V., VI. and VII. were found badly torn and the ends united by a solid cicatrix about 1.5 cm. long. This was resected and end-to-end suture of the freshened stumps made with chromic gut. She made an uninterrupted recovery.

One year after operation she could abduct the shoulder through the full range to nearly vertical, could rotate the humerus outward almost to the normal limit. The subluxation of the shoulder was almost gone spontaneously. She could flex elbow completely, could supinate about 75 per cent. of normal, moves the digits and wrist freely and with strength. She can put her palm to her mouth, on the top and on the back of her head.

To a question as to how early he liked to operate on these cases Doctor Taylor replied that in cases in which there was no question as to the necessity for operation three months was the optimum time if the arm was held in proper position up to that time. The great difficulty was that these cases were likely to go without proper support to the arm and developed secondary deformities as the result of the nerve paralysis. He would say that three months was about the optimum time for operation.

CASE I. *Neurofibromle*.—Dr. A. S. Taylor presented a woman, aged thirty-six years, who, in November, 1913, felt stiffness in the neck on awakening. In January, 1914, developed pain between scapulæ: usually appearing at night: relieved by getting up and walking. If she rested during the day the pain would appear. In June, 1914, the pain spread to the shoulders and down the arms to elbows. The pain was sometimes sharp and stinging and sometimes a dull ache. Sometimes the arms felt heavy and sometimes felt pinched. In September, 1915, she first noticed trouble in climbing stairs, especially with right leg. Any jolt or jar caused sharp pain between the scapulæ. In October, 1915, the feet became numb and this numbness crept steadily upward. In December, 1915, she lost power in the right upper extremity which also became numb. Soon the left upper extremity was also involved. In early January, 1916, she became bedridden with loss of sphincteric control.

She was a medium-sized woman, well nourished and of fair color. The upper level of anæsthesia to all types of stimuli ran across the chest just below the first ribs and down the ulnar half of the arm, forearm and hand on each side. There was marked loss of power in the upper extremities and complete loss in the lower extremities. The sphincters were paralyzed.

The K. J.'s and A. J.'s were exaggerated. Babinski and Oppenheim reactions were present on both sides. Blood and spinal fluid Wassermann's were negative. Spinal fluid culture was negative.

Diagnosis.—Spinal cord tumor about the level of D. I.

Operation (January 31, 1916, at the New York Hospital).—A right unilateral laminectomy involving C. VI., VII. and D. I. and II. was done. A tumor was felt beneath the exposed dura, which was then split longitudinally. A soft, friable, lobulated, vascular tumor about $3\frac{1}{2}$ by 1.5 by 1 cm. at its thickest portion extended from C. VII. to D. II., lay beneath the arachnoid, lay chiefly on the right side of the cord running forward laterally, and also extending a little to the left of the median line dorsally. It peeled out readily, having no adhesion to the cord substance proper. The posterior veins of the cord were intensely engorged and the cord was somewhat flattened postero-laterally. The dura was closed by fine catgut, and the superficial structures by layer sutures.

On the sixth day she recovered bladder control. On the thirty-fifth day she recovered bowel control. On the fortieth day she took a few steps. She made rapid progress to complete recovery.

The healing was perfect, the spinous processes are present and give an absolutely normal appearance to the spine. A number of surgeons emphasize the statement that this procedure ought never to be used.

CASE II. *Endothelioma of the Dura*.—Dr. A. S. Taylor presented a second case, a woman, aged thirty years, who in December, 1917, had pain in left lower dorsal region. Jolting increased this pain. Six months later the pain had spread to the right side and was more severe and persistent. In October, 1918, there was a left drop-foot

and spasms of muscles in right leg. In January, 1919, left leg was paralyzed, and the feet felt numb. The right leg soon began to lose power. In April, 1919, there was partial loss of sphincteric control. There was constant pain about the waist.

She was a tall, slender, pale woman. Left lower extremity was paralyzed. Right showed slight muscular power. Sensory disturbance extended up to the level of D. IX. on the right side and D. VIII. on the left side with a zone of hyperæsthesia one segment above on each side. There were some irregular areas on the right leg and foot where touch or pin prick or both were appreciated. She could not tell the position of any of her toes. The abdominal reflexes were absent. K. J.'s and A. J.'s exaggerated on both sides L. 7 R. Left ankle clonus is almost inexhaustible. Right ankle clonus is about one-half as persistent. Babinski and Oppenheim present on both sides. Blood and spinal fluid Wassermann negative. Spinal fluid normal. Tenderness over the spines of D. VI. and D. IX.

Operation (May 7, 1919, at the New York Hospital).—Left unilateral laminectomy, involving D. IV, V., VI., and VII. Beneath exposed dura a circumscribed tumor was felt extending from D. V. to D. VII. The dura was split and a soft, purple, capsulated tumor about 4 by 1 by 1 cm. was exposed. It was adherent to the dura just below and behind the root of left D. V. This small piece of dura was excised and the tumor lifted out with it. The tumor showed two constrictions which made an upper large lobule and two smaller lower ones. The tumor was entirely left postero-lateral and had caused two shallow compression areas in the cord. The wound was closed by layer sutures without drainage. Recovery rapid and uneventful. On the thirteenth day she walked twenty-two steps and was taken home where she made a complete recovery.

Pathological Report: Endothelioma of the Dura (Psammoma).—Here again the unilateral laminectomy gave a perfectly satisfactory exposure and working field.

DR. HAROLD NEUHOF stated that in regard to the hemilaminectomy, Doctor Taylor had inferred that it was indicated in some cases. It had proved unsatisfactory in his hands. It was his impression that the exposure obtained by a unilateral laminectomy was not adequate for a general exploratory investigation. If the localization of the lesion was clear as in Doctor Taylor's case in which the tumor lay on the right side, then a hemilaminectomy might be satisfactory and might fit that situation well, but the operation was one having strict limitations. The basic principle is not whether one approaches the cord by a hemilaminectomy or by a total laminectomy, but that the exposure shall be such that the cord shall be exposed to the minimum manipulation, and manifestly the minimum of manipulation of the delicate structures was secured with a total laminectomy. Doctor Taylor had spoken of preserving the spinal processes for the sake of preserving the external contour.

He did not think that was a particular advantage, as the space occupied by the spinal processes removed by the total laminectomy is filled in with muscle and fascia, so that a normal external appearance is preserved.

DOCTOR TAYLOR said he had seen a number of bilateral laminectomies in the neck where the ligamentum nuchæ had been damaged. Being deprived of their elastic support these patients complained of more or less neckache because their muscle had to substitute for it. In the cervical region hemilaminectomy gave ample opportunity to do any operation. If the tumor was on the front part of the cord he thought it could be reached better by the lateral laminectomy. Hemilaminectomy had been sweepingly condemned, often by men who had given it no fair trial. The point he wished to emphasize was, it could not be done well unless one had tools adapted to the purpose. The ordinary tools found in the operating room were not adapted to hemilaminectomy. While the field for this procedure was distinctly limited, it had served a most useful purpose in many patients.

POST-OPERATIVE ABDOMINAL ADHESIONS AND ANOMALOUS MEMBRANES

DR. A. S. TAYLOR presented a woman, fifty-one years of age, who in 1905 had an attack of acute pain in the right lower quadrant for one whole night. Although she was not confined to bed, she thereafter suffered constantly from pain and tenderness in the R. L. Q., and from gastric pain, flatulence and constipation. In 1907 the appendix was removed and the gall-bladder explored. In 1909 she had typhoid fever and following recovery from that she seemed perfectly well until 1916, when she developed muscular rheumatism, followed about six months later by digestive disturbances, pain, flatulence and constipation. In 1917 the removal of abscessed teeth caused the disappearance of the muscular rheumatism, but the digestive disturbances persisted and increased. In 1918 she suffered a serious "nervous breakdown" incapacitating her for her work for about six months. In February, 1919, her digestive troubles had become almost unendurable in spite of prolonged medical treatment of the best quality.

She was a woman of small stature, well nourished, of fair color, with drawn expression. The ascending colon, markedly distended with gas, could be rolled under the fingers and was quite tender to pressure. The X-ray series showed the cæcum mostly in the true pelvis, and it and the ascending colon showed considerable dilatation and retention of barium. At the hepatic flexure there was distinct kinking and narrowing of the lumen of the gut.

The abdomen was opened at the New York Hospital March 8, 1919, through a transverse right rectus incision 2 cm. above the level of the umbilicus. Dense adhesions were found binding the outlet of the stomach, the transverse colon and upper ascending colon to each other and to the

ABDOMINAL ADHESIONS AND ANOMALOUS MEMBRANES

edge of the right lobe of the liver; dense adhesions 3 cm. wide between the omentum and the whole length of the old incision; adhesions between omentum and ascending colon producing sharp kinking of the hepatic flexure; adhesions about the cæcum; a band across ascending colon, causing kinking and constriction.

The adhesions and bands were dealt with by tedious dissection and separation, and the covering in of raw surfaces wherever possible. As a result the viscera were mobilized, but there were many raw surfaces which could not be covered over. The wound was closed by layer sutures.

For the first nine days of the post-operative period there was great gas distention with constant severe pain, especially in the sigmoid region. Phlebitis appeared in the left femoral and external iliac veins toward the end of the first week.

On the ninth day the sutures were removed and there was good primary union. Convalescence was slow but steady. She sat up on the thirty-fourth day and left the hospital on the fifty-sixth day. The after-treatment was aimed at keeping the gut mobilized and at preventing permanent adhesions if possible. It consisted in abdominal massage with the colon filled with hot water; daily exercises for the abdominal muscles; and deep breathing exercises. The diet was carefully supervised and laxatives were used at first.

She made steady improvement, and nineteen months after operation reported that she had gained weight and color, had good appetite, no discomfort after food, had regular daily movements and no trouble with gas. For a year she had taken no cathartic except an occasional dose of agar-agar or an occasional enema. The abdomen showed no tenderness to pressure anywhere, there was no distention, and both scars were flexible. She was extremely faithful in her part of the after-treatment. The chief point of interest in the case lies in the effect of systematic after-care in the prevention of crippling post-operative adhesions.

DOCTOR DOWNES asked Doctor Taylor why he waited thirty days to start the colonic irrigation and massage and whether he did not think the adhesions had reformed by this time. If one was going to use irrigation and massage he thought it ought to be employed immediately. Doctor Downes said that in order to prevent this he moved his patients from side to side soon after they came out of ether. He also used colonic irrigation and mild cathartics, but he did not wait thirty days. If one waited thirty days one felt that the patient was back where he was before the operation, so far as the adhesions were concerned.

DOCTOR TAYLOR admitted that his success in this case might have been due to good luck. He was sure, however, that if they had seen this patient before the end of thirty days, colonic distentions would not have suggested themselves, as she had about all she could endure in the way of discomfort. Adhesions thirty days old were not as bad as when they were five or six years old. Of course, one case did not prove anything.

That this patient was reasonably well made him think not that the method was a cure for adhesions, but that anything that had seemed to help was worth while reporting. He had used this method in the after-treatment in ordinary laparotomies and he had had better results than when it was not included.

CERVICAL RIB

DR. A. S. TAYLOR presented a man, aged twenty-two years, who in April, 1920, noticed that his right upper extremity was larger than the left and was cyanotic and cold. It tired much more quickly than formerly. Once he had tingling in the first three fingers, but never any real pain.

Examination showed the right upper extremity to be larger than the left by 3 cm., both in the arm and forearm, the veins twice as large and the whole extremity cyanotic. No atrophy, no obvious loss of strength, and no change in sensibility. On the right side of the neck at the level of C. VII. vertebra there was a bony prominence, apparently a cervical rib. Just below and in front of this prominence is the subclavian artery which is well above the level of the clavicle. Pressure upon the lower roots of the brachial plexus as they run over this prominence causes tingling in the fingers. The left side of the neck seems to be normal.

X-ray picture shows the transverse processes of C. VII. to be large and heavy, and to extend beyond the level of the transverse processes of D. I., especially on the right side.

Operation (June 18, 1920, at the Fordham Hospital).—An incision was made, oblique upward and outward over the tip of the transverse process of C. VII. right side. The brachial plexus was mobilized forward and inward. The scalenus muscle was split down to the tip of the rudimentary rib, which was then freed from the surrounding soft tissues by dissection, so as not to elevate its periosteum which must be removed with the bone.

The tip of the rudimentary rib projected .5 cm. beyond the posterior tubercle of the transverse process and extended downward nearly to the first rib. From its tip and lower border firm fibrous bands stretched downward and outward onto the first rib. Over these bands C. VIII. and D. I. passed, but did not seem to suffer from pressure. After the bands were divided the rudimentary rib was removed by rongeur except for its innermost part. The wound was closed without drainage.

On recovery from ether there was numbness of the entire extremity, complete loss of power in the shoulder muscles, and marked loss in the other muscles. On the second day the cyanosis and enlargement of the veins had disappeared, the numbness and loss of power became less and he went on to a rapid recovery and has been well ever since. On the twenty-fifth day the right forearm was 0.3 cm. larger and the upper arm 1.2 cm. larger than the left, as compared to 3 cm. difference preceding operation.

REMOVAL OF GASSERIAN GANGLION

DOCTOR TAYLOR stated that he had done a half a dozen of these operations, some bilateral and some unilateral, using the same exposure that he did for brachial plexus operations. This was ideal for cervical rib cases because the chief difficulty was to avoid any paralysis from pressure on the brachial plexus. The first case had paralysis from the retraction of the brachial plexus. The incision was made from the sterno-clavicular notch upward and backward over the tip of the transverse process of the seventh cervical, which gave a perfect exposure. He went back of the brachial plexus and exerted no undue tension, and cut the rib close up to its articulation with the vertebra. It was almost impossible to remove it at the articulation, as there was danger of damaging the vertebral vein and causing troublesome hemorrhage.

SUPRAORBITAL NEURALGIA—REMOVAL OF GASSERIAN GANGLION UNDER LOCAL ANÆSTHESIA

DR. A. S. TAYLOR presented a man, aged fifty-nine years, who in July, 1917, first had a sudden attack of sharp, shooting pain over the right eye. It lasted a few minutes and suddenly disappeared. This pain could be precipitated by touching the upper face with cold water or exposure to cold draft. The pain gradually became more frequent in occurrence and more severe in degree.

On July 1, 1918, after it had lasted for a year, the supraorbital nerve was avulsed and he got complete relief for eleven months. At the end of that time a similar operation was tried again but with no result. There is now also occasional pain in the second branch. His general health has remained very good.

Careful neurological examination showed only hypæsthesia over the area of the right supraorbital nerve (post-operative). The radial arteries were somewhat tortuous and palpable, indicating possible arteriosclerosis. The right eye showed only slight perception and slight perception of motion. Its pupil was fixed and irregular. Also there was some incoordination of the movements of the right eye (this is the result of an injury in 1894).

Because of his attacks of pain over a period of four years, because of the failure to get relief by peripheral procedures and because of the pains having become so severe and frequent as to incapacitate him, it was deemed advisable to operate. The pain was of the characteristic lightning type.

Operation (January 25, 1921).—Morphine was administered $\frac{1}{8}$ of a grain one hour before operation, and this dose was repeated thirty minutes later. The soft tissues of the operative field were infiltrated with novocaine, $\frac{1}{2}$ per cent. with adrenalin 1-100,000, some twenty minutes before the operation was started. The patient was placed in a semi-sitting posture with the head turned toward the left. Incision was made from the middle of zygoma upward and slightly backward for a distance

of 7 cm. This incision was carried down through the skin and aponeurosis of the temporal muscle, the fibres of which were then split until the bone was reached. The muscle was then elevated from the underlying bone with an elevator. The aponeurosis was divided at the zygoma for 1 cm. forward and backward of the incision to permit more freedom in retraction. A self-retaining retractor was placed in the wound and the blades separated. This exposed an area of bone about 3 cm. wide and considerably longer in a vertical diameter. The bone was perforated and then removed by means of a rongeur which removed an area of squamous bone about 4 cm. in diameter, and encroached on the floor of the skull a little beyond the temperosphenoidal ridge. The dura was elevated gently from the base of the middle fossa. This procedure was quite painful to the patient. The dura was somewhat thickened and more adherent to the bone than usual. The dura was elevated until the middle meningeal artery was exposed. This artery was avulsed from the dura, pinched for a moment or two with a clamp, and then tucked down in the foramen spinosum where it gave no further trouble. Attempts to elevate the dura further were quite painful, so that some of the anæsthetic solution was placed on a pledget of cotton in the depth of the wound, and also by means of a long slender needle some of it was injected into the capsule of the ganglion. After waiting a few moments manipulations could be again started with greatly diminished pain. The third branch from the ganglion was identified, the overlying dura divided, and the canal from the posterior fossa over the petrous bone into the middle fossa was opened with some escape of spinal fluid. The root of C. V. could not be seen. There was a thick, dense layer of fibrous tissue which formed the floor of the canal just mentioned. Pressure upon this floor caused sharp pain in the distribution of C. V. This thickened floor was split longitudinally, and beneath it lay the root of the nerve. The nerve hook was placed around the root and an attempt made to avulse it. This caused great pain and the root did not give way as it customarily does with slight traction. Therefore, the only thing left was to divide the root where it was exposed. This was done by means of scissors when the root was elevated on the nerve-hook. The canal in which the root lay was carefully inspected to see that no fibres had escaped. After the root had been completely divided with the hope of getting a specimen for the pathologist, the stump of the posterior root was grasped with thumb forceps and an attempt made to avulse it. It did not yield at all and the pain was so great that the attempt was given up. There was little or no hemorrhage at the end of the procedure, and the wound was closed by layer sutures. The man was returned to bed in good condition, the operation having lasted about one and three-quarters hours. The special feature about this operation under local anæsthesia is the very great freedom from hemorrhage.

The post-operative course was uneventful. He had the usual dull

MUSCULOSPIRAL PARALYSIS

headache which most of these patients have for the first two or three days. On the second day he sat up in a chair and thereafter sat up every day. He began walking around on the third day. The sutures were removed on the fifth day and he had a good primary union. He returned home on the eighth day in good condition with the wound firmly healed and with a typical anæsthesia over the area supplied by the right C. V.

His maximum temperature following the operation was 101.4° twenty-four hours after his operation. On the third day it was normal and so remained thereafter.

MUSCULOSPIRAL PARALYSIS

DR. A. S. TAYLOR presented a man who had been operated upon in the days of the "Lane plate." Following the operation he had musculospiral paralysis, and a second operation was done on the musculospiral nerve which was said to have been an end-to-end suture. Three years later he came to the Neurological Institute. There was a separation of the torn ends of the biceps and brachialis anticus muscles and a defect of four inches in the musculospiral nerve. This was bridged and the upper and lower parts of these muscles sutured with strong silk sutures. Moderate power of flexion of the elbow has resulted.

The reason Doctor Taylor brought the patient was to ask these questions: (1) Would it be worth while to try another nerve graft? (2) Would one be entitled to resect three inches of the humerus? (3) Whether one would perhaps increase the amount of union of the muscle and get better function by bone resection? (4) Would bone-grafts rendering the wrist rigid in extension improve the value of the finger flexion, or would it be better to do tendon transplantation to overcome the drop-wrist?

HYGROMA OF NECK THREE YEARS AND EIGHT MONTHS AFTER OPERATION

DR. CHARLES N. DOWD said that about eight years ago during a single year three cases of hygroma of the neck came to his notice (*ANNALS OF SURGERY*, July, 1913) and since that time an occasional reference to other cases has been noted. The pathology of this condition has been well worked out as being a sequestration of the embryonic lymph-vessels. Arnold, of Heidelberg, had carefully studied the problem and had described the condition many years ago. The origin was apparently from the developing lymphatic system. The prognosis was not always good.

He now presented a child, five years of age, as an example of an advanced degree of hygroma in whom a satisfactory cure has been obtained by operation.

She was first seen October 24, 1916, when fifteen months old. At birth there was a soft lump at the right of neck about the size of a hen's egg. This increased moderately for thirteen months, but had grown very rapidly for two months. The child looked weak and feeble. Her birth

had been premature and she had only reached a weight of thirteen pounds two ounces at the age of fifteen months. She had not gained at all in weight during her first seven months.

There was a lobulated, thin-walled, cystic mass which projected from the entire right side of the neck from the ear outward and downward, over the shoulder and backward on to the scapula. It had an elastic feel and was faintly translucent. It had a transverse band across it. The diameter of the lower portion was four inches.

Her condition was so bad that an operation did not seem advisable at that time.

On December 2, 1916, an effort was made to withdraw fluid by aspiration and 2 c.c. of thin fluid was withdrawn and $\frac{1}{2}$ c.c. of 3½ per cent. tincture of iodine was injected. At this time it was evident that there were many loculi in the cyst, for only a little fluid could be withdrawn.

The child was kept under observation and treatment for six months. During this time an unsuccessful effort at radium treatment was made. She was so debilitated and weak that it was doubtful whether she would ever gain enough strength for an operation.

By June 4, 1917, she had gained as much as she seemed likely to gain, hence an excision of the hygroma was done.

A long transverse incision was made from the clavicle across to the scapula. The lobulated growth was dissected out completely. Its attachments ran in close to the transverse cervical vertebra, downward behind the clavicle, backward over the scapula and outward to the tip of the shoulder. Its walls were thin and contained limpid fluid. Its gross appearance and the pathological report both indicated that it was a hygroma.

She made an excellent recovery and is apparently free from recurrence. Since nearly four years have now elapsed since the removal of the growth there is good reason to believe that her cure is permanent. She has gained satisfactorily in strength and now has the appearance of a normal, healthy child.

PARTIAL COLECTOMY FOR HIRSCHSPRUNG'S DISEASE

DR. CHARLES N. DOWD presented a child who was first seen by him on March 21, 1920. She was then ten and one-half years old. During the first seven years of her life she had enjoyed good health, then she began to lose strength and was quiet and listless. When she was eight and one-half years old she began to have severe attacks of abdominal pain in the epigastrium on both sides. These came on at irregular intervals and were accompanied by constipation. Her disability increased continually and by December, 1919, she had become a real invalid, going about from one doctor to another, seeking relief from her distress, weakness, pain and alternating constipation and diarrhœa. She vomited only once. Micturitions were frequent. Her mother described her as "always cramped with pain and diarrhœa."

PARTIAL COLECTOMY FOR HIRSCHSPRUNG'S DISEASE

She was thin and emaciated, and had a large abdomen. There was a mass in the left side which felt remarkably like a kidney tumor. This, however, disappeared with colon irrigations after a very large discharge of fecal matter. Intestinal washings were tried for a time, but disability and general wretchedness continued. X-ray pictures showed a dilated colon.

An operation was done on April 10, 1920. The transverse colon presented in the wound and was extremely dilated. The sigmoid also presented in a similar way.

It was not practicable to remove either of these portions without removing both, hence the outer leaf of the peritoneum was cut beside the splenic flexure, the entire transverse and descending colons were then mobilized, the mesenteric attachments were divided and the colon from the hepatic flexure to the lower sigmoid was delivered through an intramuscular incision above the left anterior iliac spine. They were fastened there and the median wound was then closed and protected with gauze and adhesive plaster.

The intestine was ligated at its exit from the abdominal wall and the protruding part ablated. The ablated portion was 40 inches long, $3\frac{1}{2}$ inches in diameter, and easily held four quarts of fluid. The stoma was allowed to open in the second day; was closed on May 28th.

The child has made a good recovery, has gained steadily in strength and weight, her bowels move daily, an X-ray picture shows an efficient though short colon, she has regained her good disposition and seems like a normal child.

DR. CHARLES H. PECK presented a woman, aged thirty years, who was operated upon at the Roosevelt Hospital on October 14, 1915, for persistent constipation of an extreme degree, with marked constitutional symptoms of fecal stasis and auto-intoxication. Her statement that she frequently went two weeks and sometimes three weeks without a movement was corroborated by her physician and her nurse.

X-ray plates taken by Doctor LaField showed a condition of pronounced megacolon, with great dilatation and enlargement of transverse, descending, and sigmoid colon.

Doctor Peck stated that he was not in any sense an advocate of colectomy for constipation operation, and that this procedure was advised only after careful deliberation and consultation with her family physician and Doctor LaField, both of whom were convinced that the condition was so extreme as to demand surgical interference.

On exploration, peritoneal bands binding down and obstructing the colon at the splenic flexure were divided, but owing to the great elongation and dilatation of the transverse and descending colon and sigmoid, a lateral anastomosis was done between the transverse colon at the junction of its right and middle thirds and the lower sigmoid, hoping thus to

short-circuit the fecal current and avoid its passage through the major portion of the distended gut. As might have been expected, this plan was a failure and simply resulted in overloading and continued stasis in the great loop of large intestine, although the anastomotic opening remained widely patent.

The patient tried to believe that there was some clinical improvement for a year or so, but symptoms were soon as bad if not worse than ever.

In the summer of 1918, during Doctor Peck's absence, she was again operated upon in Boston, adhesions being separated, but no direct attack on the intestine being attempted. A large ventral hernia followed this operation, and through the hernia an enormous fecal tumor could be felt filling the upper left abdomen.

A third operation was performed on March 20, 1920, the isolated loop of gut, consisting of two-thirds of the transverse colon, descending colon and sigmoid, was enormously distended and filled with fecal matter. The old anastomosis was widely open, admitting four fingers easily.

Partial colectomy was performed, removing the entire dilated segment including the old anastomosis, and end-to-end suture was performed between right part of transverse colon and the lower sigmoid just above the pelvic brim. The ventral hernia was repaired by lateral overlapping, the operation taking two hours. A good recovery ensued without complications and the fourth day the bowels moved without catharsis or enema. She has continued to improve, has gained in weight and is completely relieved of the symptoms of auto-intoxication.

The segment removed measured 132 cm. (55 inches) in length, and from 4.5 to 9 cm. in diameter; the intestinal wall was thinned and the lumen greatly dilated.

CYST OF THE MESENTERIOLUM

DR. CHARLES N. DOWD presented a woman, aged forty-two years, who first came to the Roosevelt Hospital on December 15, 1920. She had been in good health until three weeks before that time, when she had an attack of severe pain in the region of the vermiform appendix. This subsided in fifteen or twenty minutes, but had recurred frequently at various irregular intervals without fixed relation to food intake and with no discoverable cause. The attacks of pain had ceased three days before admission. Two days before admission she had vomited for the first time and she had vomited several times since.

She showed slight rigidity of the right rectus muscle, and there was a rather indistinct feeling of a mass in the region of the right kidney. Cystoscopy was negative. Pyelography showed a normal outline of the kidney calyces. An X-ray picture indicated pericolic adhesions.

A blood count gave white blood-corpuscles, 4800; polynuclears, 64 per cent.





FIG. 1.—Cyst of mesenteriolum. The cyst and the appendix vermiformis are included in the same layer of peritoneum. The inner wall of the cyst and the inner wall of the appendix are of different structure and are distinct from each other.

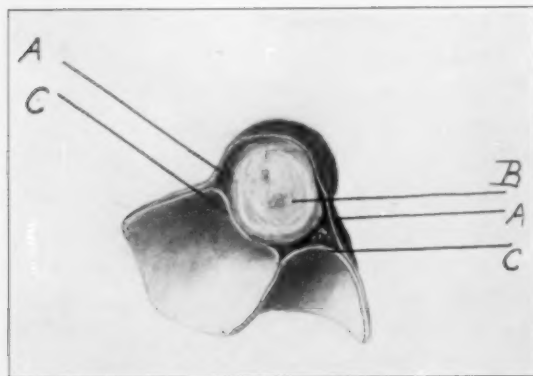


FIG. 2.—Transverse section of vermiform appendix and cyst of mesenteriolum. A. Peritoneum of mesenteriolum which also covers the appendix. B. Wall of appendix. C. Socculi of cyst, pushing the layers of peritoneum apart and extending the wall of the appendix.

After several days of observation and palliative treatment she still had a sense of discomfort in the appendiceal region, and an operation was done on December 22nd.

The appendix lay high and inward toward the spine; it was incorporated in the wall of a cyst which had a diameter of about 6 cm. The cyst and appendix were removed together. The appearance is shown in Figs. 1 and 2.

Cysts occurring in the various parts of the mesentery are among the rare surgical conditions. There is, however, a fairly steady report of such cysts, and most surgeons see them occasionally. They usually occasion difficulties in diagnosis. As a rule, they are curable by operation. No case has so far come to the writer's notice in which a cyst has occurred in the mesentery of the appendix, but one sees no reason why it should not occur there as well as in other regions of the mesentery, and in all probability many others have been found there.

Doctor White's pathological report is appended.

Macroscopic Examination.—Specimen consists of appendix and cyst. The appendix measures 5 cm. in length and is incorporated in wall of cyst, the tip and distal portion being free, while the larger central portion of appendix is apparently, from external appearance, in the wall of the cyst. The cyst measures 5 to 6 cm. in diameter, is thin-walled and on section contains clear amber fluid. The cyst is bilocular, in that it contains a small cyst of same nature measuring about 2 cm. in diameter and occupying about a third of cystic mass. On section through appendix and cyst it is determined that cyst is not of appendiceal origin, as it is entirely separate from appendix, with no connection with its lumen. The external covering of cyst is continued over external surface of appendix, while the inner lining of cyst, a smooth whitish glistening membrane about .08 cm. in thickness, is reflected over the cystic surface of appendix. The wall of appendix proper measures from 1 to 1.4 cm. in diameter. It is firm and grossly fibrosed. No lumen can be demonstrated. The tissue lying between the external coat and the cyst lining where they divide to include appendix is firm, reddish and evidently a somewhat vascular connective tissue.

Sections.—Two.

Microscopic Examination.—*Section 1* includes appendix, external wall and cystic wall, with included area between as described grossly, with lens examination appearance corresponds to gross description. The appendix proper shows lumen to be very small, lined with normal mucous membrane with submucosa containing few glands and showing encroachment of fibroblastic tissue. The wall shows marked thickening with connective tissue, numerous capillaries and some larger thick-walled blood-vessel areas of fibroblastic proliferations and round-cell infiltration of muscle-coats and wall in general. The area between the surfaces reflected from appendix shows marked round-cell infiltration of tissue with blood. Area is very vascular and somewhat oedematous. The lining of the cyst in places shows a single layer of low, flattened epithelium in some areas of low cuboidal nature, with rather large normal nuclei. The wall of cyst is composed of connective tissue rich in fibroblastic capillaries and is oedematous. The outer portion of wall is vascular and hemorrhagic and infiltrated with round cells. *Section 2* shows the same picture. *Sections 3* and *4* of cyst wall with septum shows same picture of wall as described above.

Diagnosis.—Mesenteric Serous Cyst. Chronic Appendicitis (Obliterative).

PERITONEAL TUBERCULOSIS

DR. FORDYCE BARKER ST. JOHN presented a woman, aged forty-eight years, who was admitted to the First Surgical Division at Bellevue Hospital, June 18, 1919, complaining of pain in abdomen and back.

Patient dated the beginning of her real trouble to the spring of the previous year when her symptoms at this time were coughing, pain in upper abdomen and chest, and fever. Since that time she had had recurrent attacks of acute abdominal pain, at times sufficiently severe as to double her up, accompanied by intermittent diarrhoea and constipation. No blood had been noted in the stools. These attacks were increased in severity by the fact that the patient complained of "having gas which she did not seem to be able to pass per rectum at times," although she belched up a great deal. In the last four months the gas pains have been almost constant, beginning after breakfast, and continuing through the day. Her appetite had been good, but she did not eat because of fear of abdominal distress. Greasy or fried food particularly aggravated the pain, discomfort and gas. Greatest relief was obtained from starvation or hypodermic injection. At times the acute abdominal pain was referred to the right scapular region. She was never jaundiced. She lost thirty-five pounds in ten months. During the past year repeated examinations had been made of her sputum, all of which were reported to her as negative for tubercle bacilli. The chest both by physical and fluoroscopic examinations was negative except for a slight amount of fibrosis. X-ray without ingestion of bismuth revealed an irregularly oval calcareous shadow, 2 by 3 cm., with a dense cortex located in the right iliac fossa about at the level of the interspinous line, suggestive of a large biliary calculus.

The abdomen was opened June 30, 1919. A thin blue gall-bladder, normal in size, with no palpable stones and no adhesions, was found. The pylorus and duodenum appeared normal. The pancreas was normal to palpation. There was an indurated mass of the ileum about 15 cm. long, and 50 cm. from the ileocecal junction, which was firm, presenting a constriction at either end with a very hard mass palpable in the centre. On the surface of the gut were small papillary masses resembling tubercles. The rest of the intestines were normal with the exception of one small area which presented a few scattered tubercle-like papules, but without constriction or thickening of the gut wall. The involved portion of ileum was resected with end-to-end anastomosis.

Pathological Report (by Dr. John McWhorter). *Gross Examination*.—Specimen consists of a resected portion of small intestine measuring 13 by 7 cm. On inspection, there appeared to be two constrictions, both of which are about 2 cm. from the resected extremities. On the serous surface there are a number of small pearly white papules that resemble tubercles. In the mesentric attachment there is a large circumscribed mass, 2 by 1 cm., which appears to be a lymph-node. On sectioning the ileum longitudinally (Fig. 3) the wall is found to be considerably thickened, averaging 1 cm. The lumen shows two constrictions, between which there is a dilatation having the form, somewhat,

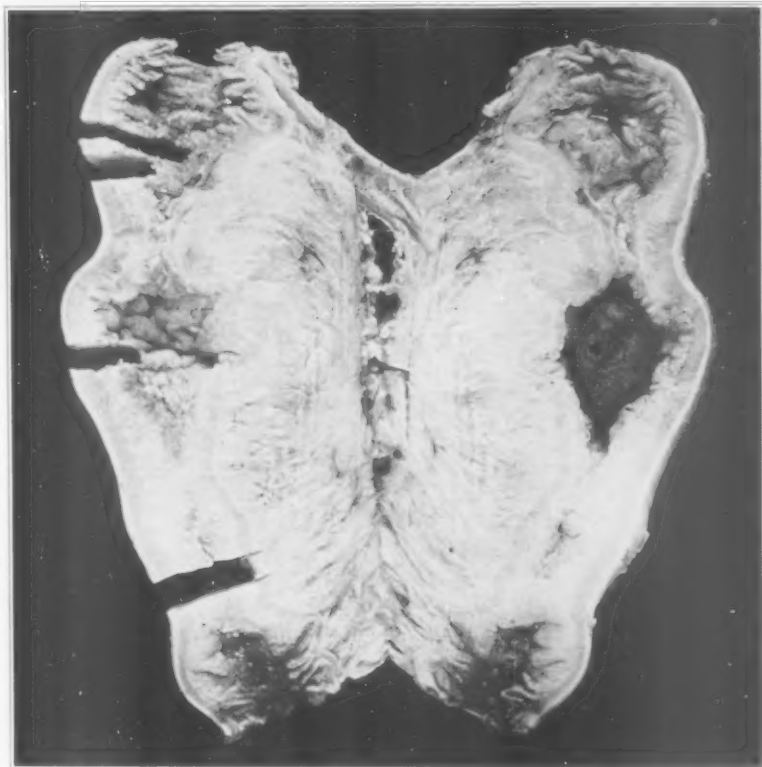


FIG. 3.—Resected portion of ileum thickened by tuberculosis, with retained biliary calculus.



CERVICAL RIB

of a pocket, in which lies a stone, oblong in shape, greenish-brown in color, that measures $1\frac{1}{2}$ by 1 cm. (Fig. 3.) Of the two constrictions the one at the distal end is most marked, apparently resulting in almost complete obliteration of the lumen.

Microscopical Examination.—(1.) Tuberculosis of intestine. (2.) Gall-stone. Analysis of gall-stone.—Biliverdin calcium, bilirubin calcium, and cholesterin.

Post-operative Convalescence.—The immediate convalescence was stormy; after that the convalescence was smooth. Out of bed on fifteenth day. Wound healed.

Follow-up Note (twenty months after operation).—Patient's weight on leaving hospital was 71 pounds; to-day it is 120 pounds; gain of 49 pounds. No pain; no disturbance of function; well with the exception of occasional belching of gas following ingestion of certain foods, especially fried. Strength is greater than she ever remembers. Appetite good. No cough or night sweats. Bowels move regularly without medicine.

Abdominal Examination.—Scar firm, no tenderness, no masses.

Economic Condition.—Capable of normal amount of work.

The case, Doctor St. Johns said, was presented (1) because of its pathological interest, and (2) because of the satisfactory result of surgical treatment to date.

CERVICAL RIB

DR. EUGENE H. POOL presented two cases of complete cervical ribs with comments on the proper operative technic in those rare cases where symptoms demand operative intervention.

In the first case the anterior method was employed and the rib was of necessity incompletely removed. Although a cure was effected, which may be regarded as permanent since six years have elapsed since the operation, insufficient rib is removed by this method to justify confidence that a cure can be relied upon. In the second case a combination of anterior and posterior methods worked out admirably. The method appears to have features to commend it, especially the fact that the rib is adequately removed.

CASE I.—Female, aged nineteen years. Admitted to the New York Hospital July 22nd; discharged July 31, 1914. Chief complaint was pain and tingling in right hand for six months before admission. Right arm felt numb. The pain and tingling persisted. Patient said that in August, 1913, she fell on the palm of her right hand. There was slight fullness in right supraclavicular fossa. This fullness was evidently bone. The right hand was slightly colder than the left. Right radial pulse barely perceptible, left easily felt. X-ray showed complete bilateral cervical rib.

Operation (July 24th).—Transverse incision three inches long; one inch above clavicle. Dissection exposed rib. Brachial plexus was drawn backward very gently and artery drawn forward with retractors. Rib was cut across as far back as possible. Its anterior attachment to first rib was divided, and the detached portion of

rib was removed. The wound was closed with one drain. On discharge wound healed. Pain had almost disappeared.

Late Result.—Patient has experienced nothing abnormal except that she tires more readily in the right than the left hand; yet she thinks the strength of the two hands is about equal. There has been no numbness nor pain. April 16, 1920, the right pulse still much weaker than left. Strength of two hands about the same.

CASE II.—Female, aged seventeen years, admitted to the New York Hospital April 19, 1920; discharged May 1st. Chief complaints: Weakness of left arm; transitory swelling of left hand; irregular pains and numbness in left arm.

Two months before admission patient noticed that while reading she could not hold a book in her left hand as long as in her right. Soon she found that she could not use her left hand at type-writing as efficiently as her right. She then noticed that her left hand began to swell occasionally. Her hand became slightly blue when the swelling was present.

At about the same time she began to have dull, irregular pains in the left arm. There was a definite, bony, resistance in both supraclavicular fossæ. On the left side there was marked tenderness. X-ray showed bilateral complete cervical ribs.

Operation.—Incision five inches long one-half inch above clavicle. Platysma and deep fascia cut, external jugular being ligated and divided. Posterior edge of sternomastoid drawn mesially; anterior edge of trapezius incised one-half inch and retracted for better exposure. Plexus easily defined by blunt dissection. This led to the surface of the cervical rib. The artery was readily recognized anterior to the plexus. The plexus was then retracted posteriorly very greatly and the artery retracted anteriorly. The rib was freed from muscular attachments without entering its periosteum; the intercostal muscles below and attachments of scalenus anticus and medius being freed. The dissection was carried backward beneath the plexus and forward to anterior attachment of rib.

The parts were allowed to fall together and the skin and fascia were freed at posterior part of wound and retracted well upward. A vertical incision was made through the muscles; namely, trapezius and levator anguli scapulæ, so that the angle of the rib was easily exposed. With bone forceps it was cut across without difficulty; with the tip of transverse process. Through the anterior portion of the wound the anterior attachment of rib was then cut, also with bone forceps. In neither case could a Gigli saw be used on account of the depth of the fact that anteriorly the rib was so overhung by sternomastoid and artery that the Gigli could not be used safely. Special care was taken throughout the operation to avoid injury to the pleura. Having cut both ends, the rib was readily drawn through the posterior incision. Wound closed without drainage. Convalescence uneventful. Wound healed per primam.

Late Result (September 5, 1920).—Patient feels well. No weak-

THE USE OF THE DUODENAL TUBE IN PREOPERATIVE STUDY

ness in left arm. No swelling. General condition good. Three weeks after leaving hospital she returned to work. Scar well healed. No nervous symptoms. No limitation of motion; no tingling nor numbness of arm.

To ensure a permanent cure Streissler claims that the rib should be removed back to the vertebra and that its periosteum should also be removed; otherwise regrowth of bone is likely to occur and to cause recurrence of pressure symptoms.

By a combination of anterior and posterior methods of approach as through one incision used in our second case the ribs may be adequately removed and permanent cure effected.

THE USE OF THE DUODENAL TUBE IN PREOPERATIVE STUDY

DR. A. O. WHIPPLE read a paper with the above title, to be published hereafter.

DR. ARPAD G. GERSTER said that in 1912 he had read a paper before the Chicago Surgical Society on "Unsuccessful Biliary Surgery," in which paper in analyzing the causes of failure he had necessarily to dwell on fundamental questions of biological pathology, and on the obscurity of the knowledge regarding the mechanical function of such an important factor as the sphincter at the papilla Vater. Collating all that was then known, he ventured to suggest, basing theory upon analogous phenomena observable in other sphincters, that retention within the biliary tract may be primarily caused by alterations of the function of the sphincter of the choledochus. In the beginning, there may be periodic spasms induced by chemico-mechanical irritation of those nervous elements of the duodenal mucosa which preside over the reflex contractions of this sphincter. If this condition becomes chronic, hypertrophy, followed by degeneration of contractile elements and the deposit of rigid scar tissue, may end in more or less complete stenosis—or even in stenosis combined with insufficiency, which, permitting regurgitation, will produce infection of the biliary ways.

Diagnostic shortcomings are the real cause of most of our failures. Of these, a respectable portion is due to lack of diligence in observation, and to failure to acquire and utilize the known means for arriving at a dependable diagnosis. Foremost of all is the omission of a careful examination of the biliary channels at the time of operation. Thus the gross mistake of leaving behind undetected calculi is incurred. But not all the fault is chargeable to the individual practitioner. It must be looked for also in our imperfect knowledge of even such a gross item of physiology as is the function of a sphincter. To do better by our patients we must know more about the normal and morbidly altered work of the sphincter of the papilla of Vater.

The discussion on his paper at Chicago was opened by Dr. Frank Billings. He paid to its reader a compliment—in his opinion the highest

that could be paid to a surgeon—which compliment he now took the liberty of passing on to Doctor Whipple. He said that "Our guest is really a physician who happens to practice surgery also." Besides approbation, this remark implied a goodly amount of irony which he was sorry to say was not always misplaced. He thought that it was far too much exaggerated in such a remark as that made by the late William H. Draper to Doctor Sands, that surgeons are, after all, nothing but "bone carpenters." The writer himself had sinned in this direction when, in discussing their derelictions, he warned his colleagues against short cuts suggested by grossly mechanical views entertained about the practice of surgery. Jocularly he ventured to call modern surgery a sort of exalted plumbing. Plumbers' work was mainly concerned with tubular systems; so was that of the modern surgeon, nine-tenths of whose work dealt with disorders of the tubes of the respiratory, digestive, urogenital, and vascular tracts.

In 1917 Dr. Samuel Meltzer, basing his proposition upon observations regarding the direct effect of sulphate of magnesia upon the sphincter of the choledochus, suggested this chemical's methodical application by means of the duodenal tube for diagnostic and possibly for curative purposes. Directly from this flowed such meritorious work as that of D. B. Lyons, of Philadelphia, and the series of important observations laid down in Doctor Whipple's paper. Their value has a surprising importance. Our ability to ascertain by a simple method whether or not the cystic duct be open is of the greatest aid in forming rational therapeutic indications. But even more good may eventually come from this method. It represents the first genuine cholangogue. All those mentioned in pharmacology before this were shams. This method may develop into a means of effective drainage of the entire biliary tract, a drainage which may be of real use in dealing with those intractable and dangerous forms of biliary infection and retention, known under the rather too comprehensive and chaotic term of cholangitis.

DR. WILLY MEYER said for the first years Doctor Einhorn had been using his duodenal tube principally in a therapeutic way, for the purpose of putting the stomach as well as the first portion of the duodenum at rest and feeding a patient with gastric or duodenal ulcer by this means for a number of weeks. As he worked with the tube, naturally his work broadened and the tube soon came to be used as a diagnostic agent, particularly in diseases of the bile system and pancreas. He had had the privilege of following this work because it was done at the Lenox Hill Hospital. They had often discussed many questions, among them whether it would be possible to diagnose more definitely gall-bladder inflammation without stones. If to the means we had to-day for diagnosing gall-bladder disease with stones could be added means of diagnosing gall-bladder disease without stones, it would be a great advantage. For the examination of gall-bladder disease with stones we had, of course,

THE USE OF THE DUODENAL TUBE IN PREOPERATIVE STUDY

the history of the patient and clinical examination, also the X-ray; but stones in the gall-bladder might be shown by the X-ray in only 15 or 20 per cent. of the cases. In his discussion he would limit himself to the diagnosis of cholecystitis without stones.

Cholecystitis without stones, Doctor Meyer said, was, as he believed, the precursor of cholecystitis with stones; if diagnosis of cholecystitis without stones could be made the diagnosis of cholecystitis with stones could also be made. For the past three to four years Doctor Einhorn and he had been investigating cholecystitis without stones with the duodenal tube, and he could claim that they had done this before Doctor Meltzer published his hypothesis of the action of the magnesium sulphate solution, the test which had now entered every clinic and hospital in our country, and perhaps abroad. It would be found that constant pain in the upper abdomen soon after meals in the great majority of cases was due to gall-bladder disease provided the X-ray failed to prove disease of the stomach and duodenum, and if the duodenal tube had also excluded disease of the pancreas. Doctor Einhorn favored examination of the duodenal contents with the patient in the fasting condition. He believed that was better than examination with the help of magnesium sulphate instillations. With reference to the bacteriology, he would mention the work of Doctor Garbat, the serologist at the Lenox Hill Hospital, New York, who had done the same while in the service with the hospital's unit at Biltmore. He found that in the fasting condition one could nicely obtain proof of the type of bacilli present in the duodenal contents. For this work Doctor Garbat received the Cartwright prize given by Columbia University.

At the Lenox Hill Hospital they had aspirated the gall-bladder and then had had cultures made. They had published observations on eighteen cases of cholecystitis without stones in which the gall-bladder was subsequently removed. The contents of the duodenum were previously examined, but magnesium sulphate instillation was done in but a few cases. They had been amazed to find the bile aspirated from the gall-bladder frequently sterile; but tissue culture examination of the gall-bladder walls showed that the latter contained the bacteria. Aschoff had made an exhaustive examination of gall-stones years ago and usually found bacteria in the centre of the stones. So it seemed that cholecystitis without stones was the precursor of cholecystitis with stones. That the bile so often was sterile might be due to the effect of the bile upon the bacteria. They would then be found in the gall-bladder wall.

DR. HOWARD LILIENTHAL stated that Doctor Crohn was doing this work in his service at Mt. Sinai, and he had operated on some of these patients. There had been one mistake in the observation of these patients by Doctor Whipple as by other workers, and that was that the examinations of the duodenal contents were not made often enough. If one introduced the tube and made the observations when a patient came

into the hospital and then before operation, after he had been cared for and purged, there might be quite a difference in the findings. Not only that, but he felt quite certain that the first gush of bile would be very much more apt to contain bacteria than bile collected several days later. If the magnesium sulphate caused the relaxation and the bile ran out from the gall-bladder, the first bile might contain more bacteria, because it would come from the neck of the gall-bladder where there was apt to be irritation by stones or stricture or by the pressure of the bile trying to force its way out.

Doctor Lilienthal suggested that in continuing the work examinations be made several days apart and the results compared. Fifty per cent. of success was not enough in a method of this kind which he believed promised well.

DR. GEORGE WOOLSEY said, in regard to the patient with absence of the gall-bladder which Doctor Whipple had shown, he had recorded in a paper read before the Society in October, 1920, in which also three faceted stones were found in the common duct, and he was unable to find any gall-bladder and there was no cystic duct. Doctor Schachner in the *ANNALS OF SURGERY*, in 1916, had reported seven cases of total absence of the gall-bladder.

The use of the duodenal tube was most valuable in connection with the diagnosis of cholecystitis without stones. It was interesting to prove by the absence of the "B" bile, so-called, the closure of the cystic duct, or by the absence of the "C" bile, the closure of the common duct, but this was not of much material assistance; it might be of help in connection with the examination of the enzymes of the pancreas in the diagnosis between impacted stone and a carcinoma of the pancreas. So far as the result of the enzyme examination went, it did not seem to correspond very closely to the gross condition of the pancreas as determined by palpation.

Stated Meeting held February 23, 1921

The President, DR. WILLIAM A. DOWNES, in the Chair

CONTUSION OF ILEUM. SLOW PERFORATION. SUTURE. RECOVERY

DR. SEWARD ERDMAN presented a man, thirty-eight years of age, an employee of the City Fire Department. While attending a fire he fell from one wall to another, landing on all fours, then rolled off this parapet, landing on his back and left hip. He could not recall striking his abdomen at any time. He experienced severe pain in the spine, left hip and foot, and a sense of soreness in the abdomen, but was able to get up and walk with assistance. He did not vomit. Physical examination on admission to the Second Surgical Division of the New York Hospital, November 8, 1920, a half hour after the accident, showed no sign externally of injury to the abdomen, which was scaphoid and held somewhat

LACERATION OF DUODENUM

rigid; there was no definite local tenderness. Ecchymosis was present over the dorsolumbar spine; there was hæmatoma of the left tibia and foot, and a number of abrasions of the head. There was no blood in the urine. The temperature was 100.6° F. and the pulse 68. The following day the white blood count was 14,600, and polymorphonuclears, 70 per cent. For two days after admission the patient seemed to improve; the abdomen became soft, and the temperature descended to 99° F. About fifty hours after admission he was seized with severe pain in the abdomen and thereafter vomited several times. On the next day, November 11th, he appeared more ill, the abdomen was held rigid, and there was marked tenderness to the right of the umbilicus. The temperature was 101° F.; pulse, 70; white blood-corpuscles, 19,000; and polymorphonuclears, 87 per cent. The X-ray of the diaphragm was negative.

November 11th a paramedian incision was made, starting above the umbilicus and extending well down until the site of the pathological condition was revealed. The peritoneum was markedly reddened, and distended coils of small intestine presented, in places translucent enough to show the fluid within. Blood-tinged serous fluid was encountered everywhere, but in no great quantity. Palpation did not reveal the site of obstruction; the distended bowel was then followed downward until a sharp kink acting as an obstruction was revealed in the lower ileum. At this point there was rather more bloody exudate, the ileum was folded over sharply to the left and attached firmly to the left leaf of the mesentery on the body of the fifth lumbar vertebra. Stellate hemorrhagic areas in the mesentery here indicated trauma. Upon dissecting the bowel free it was seen that a small perforation, approximately 3 mm., on the convex surface of the bowel had occurred and there was a loss of some of the surrounding serous coat. The obstructive symptoms, caused by the sharp kink, were relieved upon freeing the bowel. The perforation was closed with a purse-string chromic suture and the raw surface covered with transverse suture of its serosa. Owing to the peritonitis already present, drainage seemed indicated. The wound was closed in layers, using silkworm gut and silk for the skin.

The wound discharged foul, colon-smelling pus, and was laid open superficially on November 17th and Dakinization employed. The patient was discharged on December 6, 1920, with the wound healed save for a small granulating area flush with the skin.

LACERATION OF DUODENUM. RUPTURE OF LIVER. DUODENAL FISTULA. JEJUNOSTOMY FEEDING. PAROTIDITIS. RECOVERY

DR. SEWARD ERDMAN presented a man, aged twenty-five years, a chauffeur. About ten minutes before admission to the Second Surgical Division of the New York Hospital, November 16, 1920, he was injured in the following manner: While standing behind his truck another automobile struck him in the back, pinning him against the level tailboard

of his own truck, and causing the corner of the board to impinge on his epigastrium. He immediately experienced severe pain in the epigastrium and vomited stomach contents without blood. His previous history was negative, except that in 1917 he was operated upon for an "abscess" of the left "shin bone." Physical examination showed several abrasions across the epigastrium. The abdomen was retracted and markedly rigid in the upper half, with maximum tenderness to the right of the mid-line. There was no blood in the urine. The blood count showed red cells, 4,900,000; hæmoglobin, 90 per cent.; white blood-cells, 12,000; polymorphonuclears, 71 per cent. The provisional diagnosis was rupture of the liver.

Two and one-quarter hours after the accident an exploratory paracentesis was carried out with trocar and cannula in the mid-line below the umbilicus, with negative results. A transverse incision above umbilicus was then made. This kind of incision was selected on account of the definite upper abdominal trauma. Upon opening the peritoneum no fluid and no gas were encountered. The transverse colon presented and appeared blue in the region of the hepatic flexure where a large hæmatoma in the mesocolon was seen. Above the colon, beneath the liver, there was a moderate amount of blood, and a small, still bleeding vessel was seen in the gastrocolic omentum, close to the antrum pylori. This was doubly ligated. More blood was found beneath the liver, and upon raising this organ a laceration 7 cm. in length by 2 cm. wide, continuous in direction with the longitudinal fissure, was seen. This was oozing slightly. It was closed with deep plain gut sutures. The hepatic flexure was now turned downward to study the hæmatoma. When seen from above the transverse mesocolon was distended not only with blood, but with imprisoned froth-like bubbles of gas. This retroperitoneal emphysema, of course, seemed to indicate bowel rupture, and the traumatized colon was first examined for perforation. None was found. Deeper opening of the transverse mesocolon revealed more gas coming from a rent in the duodenum as it crossed the vertebral column. The tear was nearly transverse and approximated 2.5 x 1 cm. This was repaired with a double layer of chromic sutures. Connected with the torn bowel was a small firm strand leading to the pancreas—possibly an accessory pancreatic duct. No further injuries were encountered and the wound was closed in layers, using silkworm gut and silk for the skin. Two cigarette drains were introduced toward the duodenal suture.

For five days following operation there was a moderate serous discharge. On the sixth day a profuse discharge from the wound occurred in gushes about ten minutes after the ingestion of fluids. Evidently after holding for five days the duodenal rupture had sloughed open. The patient was put on continuous suction. On the seventh day 4000 c.c. of fluid was collected from the wound. The patient was still receiving fluids by mouth.

At a second operation, on the eighth day (November 24th), a jejunos-





FIG. 4.—Apparatus used for continuous aspiration and collection of duodenal secretions; also jejunostomy feeding tube receiving saline.

tomy was performed under local anæsthesia. From the ninth to the twenty-second day feeding was entirely by the jejunostomy tube. The duodenal fistula persisted from the sixth to the eighteenth day, when it spontaneously closed. For the first eight days the daily output of the secretions collected was between fifty and sixty ounces.

A left parotitis appeared on the eighteenth day and threatened to cause suppuration, but resolved entirely in fourteen days, resolution being helped by probing Stenson's duct. On the twenty-fourth day the jejunostomy tube was removed and no leakage occurred. Both wounds closed promptly and on the thirty-fourth day the patient was discharged with only granulating areas.

The jejunal feedings were two-hourly eight-ounce meals, consisting of olive oil, milk powder and glucose mixed with the entire secretion from the fistula. In the intervals saline by the Murphy drip was introduced into the jejunum. No irritation of the skin occurred about the fistula. The patient was discharged cured on December 20th and at that time weighed 115 pounds. On December 30th he weighed 130 pounds.

The parotitis was probably incited by stagnation and concentration of the saliva during the long period in which no fluid nor food was given by mouth. To rectify this salivary inactivity the patient was later encouraged to use chewing gum.

The accompanying illustrations (Figs. 4 and 5) show the method employed to attain continuous aspiration of the duodenal secretions, which entirely prevented excoriation of the skin and permitted collection in a sterile bottle at the side of the bed, for later administration with feedings.

The jejunostomy tube with its suspended glass funnel is being used for the Murphy drip instillation of saline solution in the intervals between the jejunal feedings.

The various tube connections are held in position by the Pool frame, which is much in use in the Second Surgical Division of the New York Hospital.

This frame, designed by Dr. Eugene H. Pool, consists of a tubular and partly semitubular iron frame with holes placed at intervals in its floor to accommodate the small elbow-shaped metal tube connection.

Arching across the bed it allows adjustment of drainage tubes at any angle without possibility of kinking or compression; at the same time it allows the patient freedom of movement, supports the bedclothes and facilitates dressing of the wound and attention to the patient by the nurse. The height is readily adjusted by means of the bed clamps.

The same principle of aspiration, with or without irrigation, is applicable to cases such as suprapubic cystostomy, biliary fistula, peritoneal and pelvic abscesses, etc.

DR. WILLIAM A. DOWNES stated that he had had the misfortune to operate on a case of retroperitoneal rupture of the duodenum in which he believed the fatal outcome was due to operating too soon. The patient

was a man who had been kicked by a mule and Doctor Downes had performed the operation within three-quarters of an hour after the accident. The man had all the symptoms of perforation, exquisite tenderness, rigidity and shock, and it was thought that he had sustained a severe abdominal injury. Upon opening the abdomen a small amount of hemorrhage was found around the free margin of the liver and the pyloric end of the stomach, and the first portion of the duodenum was somewhat congested. There did not appear to be gas or free fluid behind the peritoneum, although a careful search was made. A careful search was also made for an opening in the gut, but none was found, and it was finally

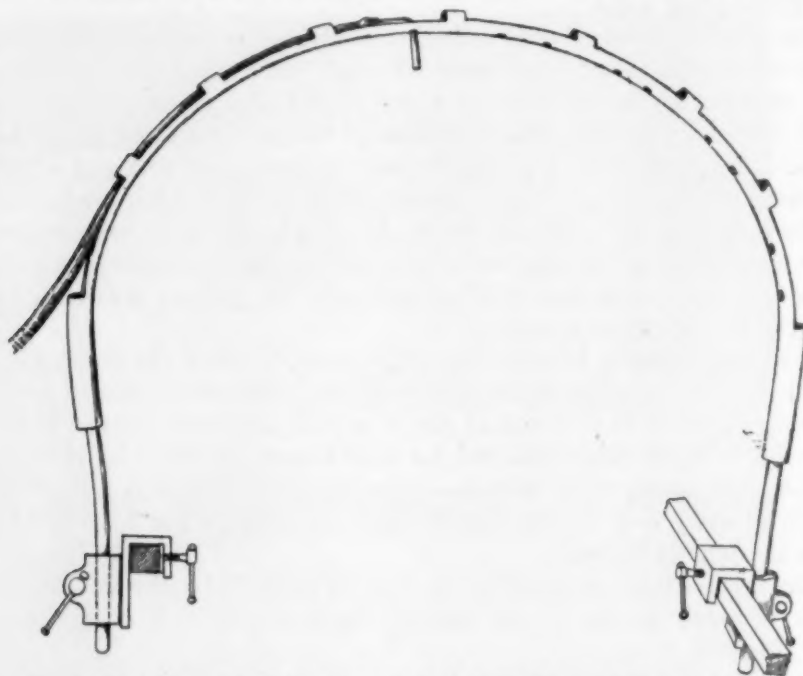


FIG. 5.—Frame support for drainage tubes, designed by Dr. Eugene H. Pool and in use in the Second Surgical Division of the New York Hospital.

concluded that the symptoms were due to shock and that the little fluid came from the liver. The incision was sewed up and the man did well for forty-eight hours, when he began to run a temperature and the right side of the abdominal wall began to show œdema and infiltration. He went along for two or three days in about the same condition and then suddenly developed symptoms of general peritonitis and died. At autopsy a retroperitoneal rupture of the duodenum was found. Doctor Downes said he felt that if he had waited two or three hours until some infiltration had occurred there might have been some evidence of retroperitoneal leakage.

DR. JOHN DOUGLAS stated that he had seen three cases of traumatic rupture of the duodenum. The first of these patients he saw at Bellevue

EPITHELIOMA OF THE DURA

Hospital two years ago. This man had been caught between two freight cars and sustained an extraperitoneal rupture of the duodenum which was easy to locate at operation. The second case was that of a man who fell from a roof and apparently had sustained an abdominal injury, though there were none of the usual signs of intestinal perforation. The man died some eighteen or twenty hours after admission. At autopsy (it was a coroner's case) a lesion was found retroperitoneally in the region of the appendix. This was traced up and a small retroperitoneal lesion found in the duodenum. He thought that the lesion was such that at operation no one would have been able to find it; it was very difficult to find this small lesion even at autopsy. This man also had a fracture of the skull. So he felt that Doctor Downes need not regret having operated too soon.

A third case of rupture of the duodenum he saw at the Knickerbocker Hotel. This patient was shot with a bullet that entered the upper abdomen anteriorly and came out posteriorly. A second bullet pierced the lung. At operation a wound of the jejunum was found and sutured. The patient died, and it was difficult to say whether she died from pneumonia or from general peritonitis. At autopsy a retroperitoneal perforation of the duodenum was found that was not discovered at operation. There was nothing more difficult at the time of operation than to make out a retroperitoneal injury to the duodenum.

CHINOSOL AND NORMAL SODIUM CHLORIDE AS WOUND DRESSINGS

DR. WILLIAM C. LUSK presented a man recovered from an extensive cellulitis of arm and forearm, in the treatment of which a solution of 2 per cent. chinosol and normal sodium chloride had been used. This case will be reported in a writing now in course of preparation.

FIBROSARCOMA OF THE APPENDIX

DR. GEORGE H. SEMKEN presented a man from whom he had removed a fibrosarcoma of the appendix. He accompanied the presentation with remarks upon that condition.

EPITHELIOMA OF THE DURA

DR. CHARLES A. ELSBERG presented a man, aged forty-five years, a patient of Dr. S. P. Goodhart, of New York City. For several years the family had noticed changes in the patient's temperament. He had shown a greater degree of excitability and impatience at home and in his business relations. During this time also he had been troubled by frequent dreams from which he would suddenly awaken and from which it would take him some time to return to normal consciousness. He began to have severe headaches with attacks of vomiting which became gradually more and more severe. The eye grounds remained negative until about one week before operation, when a rapidly advancing papilloedema showed

itself. There were slight signs referable to pyramidal tract irritation on the right side. The X-ray examination showed a few small slightly irregular areas of bone absorption in the left frontal and parietal bone. The diagnosis of tumor in this area was made and operation performed in May, 1919, by Doctor Elsberg. A large osteoplastic flap with its base in the temporal region and exposing the parietal and temporal adjoining regions, was turned down and the dura widely opened. There was a moderate increase of intracranial pressure. As soon as a dorsal flap was reflected, a brown tumor mass was to be seen in the upper and anterior parts of the exposed cortex. Over the central part of the growth the dura was firmly adherent to it. The limits of the tumor were well defined, and after the ligation of a number of pial blood-vessels the tumor was freed on all sides. It was buried to a depth of 5 cm. in the cortex, but it was well encapsulated, so that it could be peeled out of its bed with little hemorrhage. One large blood-vessel, evidently the nutrient vessel of the tumor, which entered the growth on its under surface, was ligated and divided. The sides and bottom of the cavity from which the tumor was removed consisted of very vascular cortex, and the brain tissue gradually filled up the cavity. The dura was closed, bone flap returned to place and scalp sutured. The wound healed by primary union, the scalp sutures being removed on the eighth day. The tumor was reddish brown in color, irregular, lobulated, and of very firm consistency; it measured 7 x 5 x 6 cm.; microscopically it was a typical endothelioma. Recovery from the operation was very satisfactory; papilloedema rapidly disappeared, and the patient felt perfectly well and has remained well up to the present time.

A second patient, also presented, was a man referral by Dr. Frederick Tilney and operated upon at the Neurological Institute, September 29, 1920. The patient began to have cramps with feeling of deadness in the right upper extremity in the summer of 1918. He was left-handed. The attacks occurred every four or five weeks without other symptoms, up to the beginning of 1920. He then began to suffer from headache with vomiting and began to notice that his vision was not as good as it had been; the headaches became more frequent and more severe, and by March he noticed that he felt queer mentally and frequently did not realize where he was. At about this time he began to drag the right foot and noticed that he had lost much power in the right arm. By September the weakness in the right arm and leg was very distinct. He had a high grade of choked disk. His mental condition was peculiar in that he seemed to be more or less in a dream and would answer questions with some difficulty. There was no speech disturbance, but the patient was very emotional, laughing or crying without cause. At operation Doctor Elsberg turned down a large osteoplastic flap. When the dura was opened a large tumor, measuring 7 x 6 cm., was exposed on the surface of the cortex. The tumor was removed with little difficulty. The patient

CEREBELLAR CYST

recovered very satisfactorily from the operation, excepting for the unusual fact that the papillœdema persisted for three months before it disappeared. He was presented perfectly well and free from all symptoms.

CEREBELLAR CYST

DR. CHARLES A. ELSBERG presented a girl, aged eleven years, a patient of Doctor Tilney, who had been operated upon in 1912, eight years before, for a right cerebellar cyst, by Doctor Cushing. She recovered very satisfactorily from the operation and remained well until March, 1920. She then began to complain of severe headaches, of difficulty with her sight, and had frequent attacks in which she became very pale and often lost consciousness. The symptoms became gradually worse, and by the beginning of April there were marked signs referable to the right cerebellum. She was operated upon by Doctor Elsberg April 30, 1920, the right cerebellum was exposed through a typical cross-bow incision, and was found to contain a large cyst, the contents of which consisted of yellow fluid. On the inner surface of the cyst were several small projections having the appearance of typical gliomatous knobs. The inner wall of the cyst was cauterized with clear carbolic acid, and the wound closed in the usual manner. Recovery from operation was uneventful. All of the child's symptoms disappeared within a few weeks and she has remained perfectly well. The unusual feature about this case was the long interval between the first operation and the recurrence of symptoms.

EXTRACEREBELLAR TUMOR

DOCTOR ELSBERG presented a woman who had been operated upon for a large extracerebellar tumor involving the vermis and the upper surface of the cerebellum. The patient had been referred to the Neurological Institute by Doctor Osnato, of New York, with the diagnosis of vermis tumor. She was markedly ataxic and emaciated, with a high grade of choked disk and with all the typical symptoms of expanding lesion in the right side of the posterior fossa. At the operation a large endothelioma, the size of a lemon, was removed. It was attached to the dura at the location of the confluence of the sinuses and was removed with great difficulty. A small bit of tumor remained attached to the region of the confluence of the sinuses and was cauterized with pure carbolic acid. The patient recovered very satisfactorily from her operation. Within six weeks all of her symptoms had disappeared, and she has remained well up to the present, more than one year after the operation.

BOOK REVIEW

A MANUAL OF SURGERY. By FRANCIS T. STEWART, M.D., Philadelphia, P. Blakiston's Son & Co. 8vo., cloth, pp. 1086.

This book appears as the fifth edition of a work which is intended for students and for general practitioners. It is a true text book of surgery, all phases of which are considered briefly and naturally more from the standpoint of diagnosis than from the standpoint of technical treatment, although the technique of the common operative procedures, such as herniotomy, thoracotomy, appendectomy, gastroenterostomy, etc., is given in considerable detail.

In describing the various techniques for the operations, the author names and submits the usual method, or methods, employed. He then concludes the discussion in many instances with a description of his own favorite method. For instance, in doing a radical mastectomy he advises the use of a transverse elliptical incision, which is, I believe, not as commonly used as some modification of the vertical incision. In doing a gastrotomy, a very clever yet simple method of producing a permanent tract (leading from the exterior into the stomach) that is completely surrounded by normal skin is described. That Dr. Stewart advocated and used celluloid thread as a suture material is evident from reading his text.

Some of the diagrams are quaint and somewhat old-fashioned, but they are pertinent and illustrate well the subject under discussion. There are, however, many very excellent modern plates found all through the book.

As a whole the work has been brought up to date, not only by the author before his death but also by Dr. Walter E. Lee, who has, moreover, added much that is of value on the subject of Military Surgery.

In conclusion, the reviewer considers that this book on the essentials of surgery will be found to be of greatest value to the undergraduate, whose time cannot be spared upon its unessentials. To the general practitioner, who seeks a guide to present-day surgical conditions, their diagnoses, and treatment, it should be a great comfort. To any medical graduate who aspires to maintain a good working library this surgery, which omits historical matter and bibliographical references, but which lays emphasis on those details which vast experience has taught to be of greatest clinical importance, will find on his shelves a welcome place.

MERRILL N. FOOTE.

To Contributors and Subscribers:

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS of SURGERY

227-231 S. 6th Street

Philadelphia, Penna.

INDEX TO VOLUME LXXIII

A

- Abdomen, Gunshot Wound of the, 129.
 Abdominal Adhesions, Post-operative and Anomalous Membranes, 776.
 Aerocele Intracranial, Following Fracture of Skull, 18.
 Anæsthesia, Local, Gastrectomy Under, 663; in Cardiac Disease, 663; Partial Gastrectomy Under, 662; Regional, 165.
 Anatomical Plates of Vesalius, Review of, 388.
 Anatomic Illustration, History and Bibliography of, by Choulant, Review of, as Translated by Frank, 389.
 Ankylosis of the Jaw, End-results of, Operation for, 314.
 Anus, Imperforate, 111.
 Appendectomy, Followed by Intestinal Obstruction, Relief by Resection, 249.
 Appendicitis, Acute, the Gibson-Mikulicz Tampon in, 473.
 Appendix Cultures, 749.
 Appendix, Fibrosarcoma of the, 797.
 Artery, Common Iliac, Preliminary Ligation of, in Hip-Joint Exarticulation, 285.
 Artery, External Iliac, Ligation of, and Vein, 265.
 ASHHURST, A. P. C.: Imperforate Anus, 111; Treatise on Surgery, Review of, 519; Fibroma of the Ovary, 772; Internal Derangements of Joints, 761; Specimens of Fracture of the Vertebral Column, 770; Treatment of Cases of Snapping Jaw, 712; Treatment of Intracapsular Fracture of the Neck of the Femur, 767.
 Asphyxia, Some Surgical Aspects of, 170.
 Astragalectomy After Chopart's Amputation, 252.

B

- Bacteriology of Infected Wounds, 4.
 BAILEY, FRED W.: Preliminary Ligation of Common Iliac Artery in Hip-Joint Exarticulation, 285.
 BAKER, JAMES NORMENT: Study of Fifty Cases of Ureteral Stricture and Pyelitis, 348.
 BALDWIN, JAMES H.: Sarcoma of Plantar, Surface of Foot, 111; Imperforate Anus, 111.
 BALFOUR, DONALD G.: The Technic of Hepaticoduodenostomy, 343.
 BANCROFT, FREDERICK W.: Acute Hæmatogenous Osteomyelitis, 681.
 BARTLETT, WILLARD: Painless Hypodermoclysis, 161.
 BARTLETT, EDWIN I.: Diagnosis and Treatment of Clinically Doubtful Breast Tumors, 740.
 BASSET, ANTOINE: Fractures of the Neck, of the Femur, Review of, 256.
 BEER, EDWIN: Effect of Radium on Cancer of the Bladder, 239; Technic of Operative Treatment of Neoplasms of the Urinary Bladder, 72.
 BEHAN, RICHARD J.: Treatment of an open Infected Wound, 701.
 Bile-Duct, Common, Drainage of, Through Cystic Duct, 458.
 Bile-ducts, Repair of Injuries to, 629.
 BILLINGS, ARTHUR E.: Pyonephrosis with late Secondary Hemorrhage, 645.
 Biliary Tract, the Use of the Duodenal Tube in Pre-operative Study of Infections of the, 556.
 Birth Palsy, 773.
 Bladder-Cancer, Effect of Radium on, 239.
 Bladder, Exstrophy of the, in the Female, 100; with Carcinoma, 354; Operative Treatment of Neoplasms of the, 72.
 BLOCK, FRANK BENTON: Mesenteric Embolism in an Hæmophilic, 229.
 Bone-Graft of Humerus for Non-Union, 244; of Tibia for Non-Union, 245.
 Bone Grafting in United States Army Hospitals, 1; Various Methods of, 253.
 Bone Transplant from Crest of Ilium to Mandible, 375.
 Bones, Tubular, Rational Treatment of Fractures of, 385.
 BOWLBY AND ANDREWS: Surgical Pathology and Morbid Anatomy, Review of, 518.
 BOYER, EDWIN H.: Hemorrhagic Cysts of the Spleen, 58.
 Brain Injuries With and Without Fracture of the Skull, Diagnosis and Treatment of, by William Sharpe, M.D., Review of, 137.

INDEX

- BREAKSTONE, BENJAMIN: Diaphragmatic Hernia, 417.
- Breast, Gelatiniform Cancer in the, 108; Papillary Cystadenoma of the, 384.
- Breast Tumors, Clinically Doubtful, Diagnosis and Treatment of, 740.
- Bronchiectasis and Lung Abscess, X-ray Studies After Direct Injection of Bismuth Mixture, 362.
- Broncho-Pulmonary Fistula, 30.
- BRODERS, ALBERT COMPTON: Squamous-cell Epithelioma of the Skin, 141.
- BROWN, HENRY P.: Congenital Stenosis of the Colon, 125; Broken Neck, 761.
- BURKE, JOSEPH: Exstrophy of the Bladder in the Female, 100.
- C**
- Cancer Infection, 294.
- Cancer of the Breast, Gelatiniform, 108; of the Bladder, Effect of Radium on, 239; of the Colon, Late Results of Resection, 233; of the Kidney, 301-310; of the Lip, Results of Surgical Treatment of, 521; of the Prostate, Symphysiotomy as an aid to the Removal of, 609; of the Skin, 141.
- Cancer of the Large Intestine, 755.
- Carcinoma of the Tongue, Treatment of, 716.
- CARNETT, JOHN B.: Calculus in Wharton's Duct, 378.
- Carpal Bone, Results Following Removal of, 659.
- Carpal Semilunar Bone, Dislocations of the, 621.
- CARR, WILLIAM PHILLIPS: End-results of Operation for Bony Ankylosis of the Jaw, 314.
- Cæcum, Non-tuberculous Inflammation of, 668.
- Cerebellum, Effects of Extracerebellar Tumor Upon, 799.
- Cervical Rib, 778, 787.
- CHANEY, L. B.: Review of Tilney and Riley's Treatise on the Form and Functions of the Central Nervous System, 390.
- CHEYNE, WILLIAM WATSON: Notice of Retirement From Collaboratorship, 392.
- China, South, Tumors in, 217.
- Chinosol and Normal Sodium Chloride as a Wound Dressing, 797.
- Cholecystectomy for Cholelithiasis, 131.
- Cholelithiasis, Observations on, 36, 131; Specific, Produced by Chemical Means, 54.
- Chondro-Sarcoma of Plantar, Surface of Foot, 111.
- CHOULANT: History and Bibliography of Anatomic Illustration, Translation of Frank, Review of, 389.
- COHN, ISIDORE: Dislocations of the Semilunar Bone, 621.
- Colectomy, Partial, for Hirschsprung's Disease, 782.
- COLEY, WILLIAM B.: Intestinal Obstruction Due to Strangulation by Meckel's Diverticulum, 568.
- Colon, Congenital Stenosis of the, 125; Partial Resection of, for Cancer, Late Result, 233; Transverse, Late Results of Operation for Removal, 660.
- COOPERMAN, M. B.: Stave Fractures of the first Metatarsal Bone, 215.
- CROSSAN, EDWARD T.: Intestinal Obstruction from Meckel's Diverticulum, 765.
- CUTLER, ELLIOTT C.: Notes on the Non-operative Treatment of Fractures, 91.
- Cystadenoma, Papillary, of the Breast, 384.
- Cystico-choledochostomy, 458.
- Cyst, Cerebellar, 799.
- D**
- DORRANCE, GEORGE M.: Fractures of the Jaw, 760; Results of Treatment of Intracapsular Fracture of the Femur by Abduction and Plaster Fixation, 752; Treatment of Intracapsular Fractures of the Neck of the Femur, 767; Tongs Extension in the Treatment of Fractures, 124.
- DOUGLAS, BEVERLY: Gravimetric Method for Determining the Superficial Area of Wounds, 673.
- DOUGLAS, JOHN: Traumatic Rupture of the Duodenum, 796; Gastrojejunal Ulcer after Gastroenterostomy, 658; Late-Results After Resection of the Stomach for Carcinoma, 653; Cholecystectomy, for the Relief of Chronic Pancreatitis, 131.
- DOWD, CHARLES N.: Experiences with Murphy Button, 650; Cyst of the Mesenterium, 784; Late Post-operative Result of Hygroma of Neck, 781.

INDEX

- DOWNES, CHARLES N.: Partial Colectomy for Hirschsprung's Disease, 782.
- DOWNES, WILLIAM A.: Large Ovarian Cyst in Infant, 134; Sleeve Resection of Mid-Gastric Ulcer, 654; the Passing of the Murphy Button, 252; Traumatic Rupture of the Duodenum, 795.
- Dura, Epithelioma of the, 797.
- Duodenal Tube, Use of, in Pre-operative Study, 789.
- Duodenum, Laceration of, with Rupture of Liver, 793.
- Diverticula of the Jejunum, 135; of the Upper Ileum, 241.
- Dislocation of the Elbow, Old Unreduced Backward, 129.
- Diaphragmatic Hernia, 417.
- DEAVER, JOHN B.: Gastroenterostomy in Acute Perforated Ulcer of the Stomach and Duodenum, 441; Hysterectomy in the Lankenau Hospital, 84.
- DAVIS, BYRON B.: Comparative Results of Pyloroplasty and of Gastroenterostomy in Stomach Surgery, 450.
- Duodenal Tube, Use of in Pre-operative Study of Infections of Liver and Pancreas, 556.
- Duodenal Ulcer, 128.
- Duodenal Ulcer in Infancy, 545.
- Duodenal and Gastric Ulcers, 328, 420.
- Duodeno-Jejunostomy for Chronic Duodenal Obstruction, 578.
- E**
- Ear, Diseases of the, Review of, by Phillip D. Kerrison, 517.
- EISENDRATH, DANIEL N.: Polycystic Kidneys and Liver, 62.
- Elbow, old Unreduced Backward Dislocation of the, 129.
- Elbow, Loose Cartilage in the, 761.
- ELSBERG, CHARLES A.: Cerebellar Cyst, 799; Epithelioma of the Dura, 797; Extracerebellar Tumor, 799.
- Empyema, Chronic, 648.
- Empyemas, Recent, Mechanical Factors in the Management of, 735.
- Endocrine Death, Post-operative, 112.
- Epididymitis, Gonorrhœal, Operative Treatment of, 357.
- Epithelioma in old Osteomyelitis Sinus, 247.
- Squamous-cell, of the Skin, 141.
- ERDMANN, SEWARD: Laceration of Duodenum, Rupture of Liver, 793; Non-tuberculous Inflammation of the Cæcum, 669.
- ERDMANN, JOHN F.: Gastrojejunal Ulcer Subsequent to Gastroenterostomy, 434; Gastrojejunal Ulcer, Following the Use of Non-absorbable Suture, 659; Late-Results After Resection of the Stomach for Carcinoma, 653; Torsion of Omentum with Acute Appendix, 252; Use of Murphy Button in Intestinal Surgery, 251.
- Exostosis of Scapula, 648.
- Exstrophy of the Bladder in the Female, 100.
- Exstrophy of the Urinary Bladder with Carcinoma, 354.
- F**
- FARR, CHARLES E.: The Gibson-Mikulicz Tampon in Acute Appendicitis, 473; Picric Acid in Operative Surgery, 13; Treatment of the Appendix, 749.
- Feet, Weak and Flat, Three Frequent Causes of, 499.
- Femur, Fractures of the Neck of, Review of, Basset on, 256; Isolated Fracture of the Lesser Trochanter of the, 117; Peritrochanteric Fracture of the, 227; Splint for Vicious Fractures of the, 495; Supracondylar Fracture of, 122; Ununited Fracture of the, Neck of the, and the Reconstruction Operation for, 245.
- Femur, Intracapsular Fracture of the Neck of, Treatment of, 767; Results of Treatment by Abduction and Plaster Fixation, 752.
- Fibroma of the Ovary, 772.
- FISCHER, HERMANN: Chronic Cholecystitis Without Stone, 133.
- Fistula, Broncho-Pulmonary, 30.
- Fluoroscopic Guidance in the Removal of Foreign Bodies, 372.
- Foot, Chondro-Sarcoma of Plantar, Surface of, 111.
- Foreign Bodies, Removal of, Under Fluoroscopic Guidance, 372.
- FORTUNE, STANLEY T.: Intestinal Obstruction due to Strangulation by Meckel's Diverticulum, 568.
- Fracture, Compression, of the first Lumbar Vertebra with Delayed Symptoms, 360.

INDEX

Fracture of Femur, Supracondyloid, 122; Pertrochanteric, 227; Isolated, of the Tuberosity of the Ischium, 117; Isolated of the Lesser Trochanter of the Femur, 117; of the Neck of the Femur, Ununited, Reconstruction Operation for, 245; of the Pelvis, Suspension Treatment in, 125.
Fracture of the Vertebral Column, 770.
Fracture Stave, of the first Metatarsal Bone, 215; of the Tibia, Ununited, 247.
Fractures Involving Joints, 378; of Long Bones, the Treatment of With Tongs Extension, 124; Non-operative Treatment of, 91; of the Tubular Bones, Rational Treatment of, 385; Ununited, the Treatment of, 487; Vicious, of the Femur, Splint for, 495; of the Jaw, 760.
FRANK, MORTIMER: Translation of Choulant, History and Bibliography of Anatomic Illustration, Review of, 389.
FRAZIER, CHARLES H.: Surgery of the Spine and Spinal Cord, Review of, 138.
FRIEDLANDER, ALFRED: Solid Tumors of the Mesentery, 211.

G

GASK AND WILSON, Text-book of Surgery, Review of, 139.
Gall-stones, Visualization of, by the X-ray, 132.
Gall-bladder, Absence of, 792.
Gastric and Duodenal Ulcers, 328, 420
Gastric and Intestinal Surgery, Some Underlying Principles of, 199.
Gasserian Ganglion, Removal of, Under Local Anæsthesia, 779.
Gastroenterostomy Followed by Ulcer of the Jejunum, 434, 647, 654.
Gastroenterostomy in Acute Perforated Ulcer of the Stomach and Duodenum, 441.
Gastrojejunal Ulcer Subsequent to Gastroenterostomy, 434, 647, 654.
Gastroenterostomy and Pyloroplasty, Comparative Results of in Stomach Surgery, 450.
GERSTER, ARPAD G.: Pre-operative Study in Cases of Biliary Surgery, 789.
GIBSON, JOHN H.: Papillary Cystadenoma of the Breast, 384; Treatment of Fractures, 387.
GIBSON, CHARLES L.: The Rubber Dam Mikulicz Tampon, 470.

GITLOW, SAMUEL: Diaphragmatic Hernia, 417.
GOLDBERG, SAMUEL: Mesenteric Embolism in an Hæmophiliac, 229.
GORSCH, RUDOLF V.: Compression Fracture of the first Lumbar Vertebra with Delayed Symptoms, 360.
GRAHAM, EVARTS A.: Some Surgical Aspects of Asphyxia, 170.
Gravimetric Method for Determining the Superficial Area of Wounds, 673.
GREEN, NATHAN W.: Benign Stenosis of the Oesophagus, 724.
GREENE, W. H. CLAYTON: Notice of Association as Collaborator, 392.
GREENE, NATHAN W.: Association of Tuberculosis and Carcinoma, 662; Implantation of Cancer Cells in Operations for Cancer of the Bladder, 239; Late Result of, Partial Resection of, Colon for Cancer, 233; Late Result of, Resection of, Head, Humerus for Sarcoma, 236; Operations Under Local Anæsthesia, 664.
GROVE, L. W.: Removal of Foreign Bodies Under Fluoroscopic Guidance, 372.
Gunshot Wound of the Abdomen, 129; of the Shoulder, 117.

H

Hæmophiliac, Mesenteric Embolism in an, 229.
HAMILTON, CHARLES S.: Hemorrhagic Cysts of the Spleen, 58.
HARRIGAN, ANTHONY: Linitis Plastica, 551.
HARTWELL, JOHN A.: Late Suture of Ulnar Nerve, 667; Late Suture of the Musculospiral Nerve, 665; Non-tuberculous Inflammation of Caecum, 668; Use of Local Anæsthesia in Surgical Operations, 664.
Heat Stroke After Operations, 115.
HENDERSON, MELVIN S.: The Treatment of Ununited Fractures, 487.
Hepaticoduodenostomy, the Technic of, 343.
HERMAN, LEON: Pseudo-Polycythemia, 223.
Hernia, Amniotic, 642; Diaphragmatic, 417; Inguinal, Recurring, Strangulation of, 641; sliding of the Ureter, 613.
Hip-Joint Exarticulation, Preliminary Ligation of Common Iliac Artery, 285.

INDEX

- HITZROT, JAMES M.: Epithelioma in Old Osteomyelitis Sinus, 247; Bone-graft for Ununited Fracture of the Tibia, 247; Treatment of Acute Suppurative Pleurisy, 531.
- Hirschsprung's Disease, Partial Colectomy for 782.
- HODGE, EDWARD B.: Calculus in Wharton's Duct, 378.
- Hodgkin's Disease Association with Ulcer of the Stomach, 670.
- HOGUET, J. P.: Duodenal Ulcer, 128; Gastric Ulcer, 128; Gastrojejunal Ulcer after Gastroenterostomy, 656.
- HORRAX, GILBERT: Intracranial Aerocele Following Fracture of Skull, 18.
- HORSLEY, J. SHELTON: Some Underlying Principles of, Intestinal and Gastric Surgery, 199.
- HOTCHKISS, LUCIUS W.: Torsion of the Great Omentum, 252; Old Unreduced Backward Dislocation of the Elbow, 129.
- Humerus, Bone Graft of, for Non-Union, 244; Resection of Head for Sarcoma, Late Result, 236.
- Hygroma of Neck, 781.
- Hysterectomy in the Lankenau Hospital, 84.
- Hypodermoclysis, Painless, 161.
- I**
- Ileum, Contusion of, Slow Perforation, Following, 792; Upper, Diverticula of the, 241.
- Iliac Artery, Common, Preliminary Ligation of, in Hip-Joint Exarticulation, 285.
- Iliac Artery and Vein, External, Ligation of, 265.
- Inguinal Hernia, Recurring, Strangulation of, 641.
- Intestinal and Gastric Surgery, Some Underlying Principles of, 199.
- Intestinal Obstruction, Following Appendectomy, Resection for, 249; from Strangulation by Meckel's Diverticulum, 568; Caused by Meckel's Diverticulum, 765.
- Infected Open Wounds, Treatment of, 701.
- Interdental Splints, 760.
- Intestine, Large, Cancer of the, 755.
- Intracapsular Fracture of the Femur, Results of Treatment by Abduction and Plaster Fixation, 752; Treatment of, 767.
- Intussusception, 638.
- Ischium, Isolated Fracture of the Tuberosity of the, 117.
- IYV, ROBERT H.: Bone Transplant from Crest of Ilium to Mandible, 375; Calculus in Wharton's Duct, 377; Interdental Splints, 760.
- J**
- Jaw-Ankylosis, Bony, End-results of Operation for, 314.
- Jaw, Fractures of the, 760.
- Jaw, Snapping, Excision of the Interarticular Cartilage in Case of, 712.
- Jejunum, Diverticula of the, 135; Ulcer of the, Following Gastroenterostomy, 434, 647, 654.
- Jejunostomy after Laceration of Duodenum, 793.
- Joints Involved in Fractures, 378.
- Joints, Internal Derangements of, 761.
- JONES, CHESTER: Salivary Calculus in an Acromegalic, 527.
- JOPSON, JOHN H.: Congenital Stenosis of the Colon, 127; Gunshot Wound of the Shoulder, 117; Mixed Tumor of the Kidney, 118; Imperforate Anus, 111; Suspension Treatment in Fracture of the Pelvis, 125; Supracondyloid Fracture of Femur, 122; Intracapsular Fracture of the Neck of the Femur, 770.
- JUDD, EDWARD STARR: Laryngeal Function in Thyroid Cases, 321.
- K**
- KELLOGG, EDWARD LELAND AND WILLIAM A.: Duodeno-Jejunostomy for Duodenal Obstruction, 578.
- KENYON, J. H.: Intestinal Resection for Obstruction Following Appendectomy, 249.
- KERRISON, Diseases of the Ear, Review of, 517.
- Kidney, Carcinoma of the, 301, 310; Mixed Tumor of the, 118; the Secretory Pressure of the, as an Index of Pathological Conditions, 609.
- Kidneys and Liver, Polycystic, 62.
- KLOPP, E. J.: Acute Inflammation of Meckel's Diverticulum, 644; Amniotic Hernia, 642; Patent Urachus With Sarcoma of Wall, 643.
- Knee, Recurrent Dislocation of the Internal Semilunar Cartilage in, 762.

INDEX

- KRETSCHMER, HERMAN L.: Renal Tuberculosis in Twins, 65.
 KROGER, W. P.: Acute, Complicating Pregnancy, 115.
 Krukenberg, Tumor of the Ovary, 481.
 Kuemmel's Disease of Lumbar Vertebra, 360.

L

- LABAT, GASTON L.: Regional Anæsthesia, 165.
 Laryngeal Function in Thyroid Cases, 321.
 LA ROQUE, G. PAUL: Ligation of External Iliac Artery and Vein, 265.
 LEE, WALTER E.: Fractures Involving Joints, 378.
 Leg, Ununited Fracture of, Treatment of, 124.
 LEVERING, WALTER: Fractures Involving Joints, 378.
 LEWALD, T.: Visualization of Gall-stones by the X-ray, 132.
 LILIENTHAL, HOWARD: Experiences with Murphy Button, 650; Prevention of Gastrojejunal Ulcer after Gastroenterostomy, 657; Duodenal Tube as a means to Diagnosis, 791.
 Linitis Plastica, 551.
 Lip Epithelioma, Results of Surgical Treatment, 521.
 Liver and Kidneys, Polycystic, 62.
 LOWER, WILLIAM E.: Exstrophy of the Urinary Bladder with Carcinoma, 354.
 Lung Abscess and Bronchiectasis, X-ray Studies of, After Direct Injection of Bismuth Mixture, 362.
 LUSK, WILLIAM C.: Chinosol and Normal Sodium Chloride as Wound Dressing, 797.
 LYON, VINCENT: Pseudo-Polycythemia, 223.
 LYNNAH, HENRY L.: Röntgenographic Studies of Bronchiectasis and Lung Abscess After Direct Injection of Bismuth Mixture, 362.

M

- Mandible, Recurrent Dislocation of, Treatment of, 712.
 Mandible, Bone Transplant to, From Crest of Ilium, 375.
 MANN, F. C.: the Production by Chemical Means of a Specific Cholelithiasis, 54.

- MASLAND, HARVEY C.: Traction Providing Splint for Vicious Fractures of the Femur, 495.
 MATHEWS, FRANK S.: Observations on Cholecystitis, 133; Mechanical Factors in the Management of Recent Empyemas, 735.
 MAYO, CHARLES H.: Gastric and Duodenal Ulcers, 328.
 McDONAGH, I. E. R.: On Venereal Diseases, Review of, 519.
 MCGLANNAN, ALEXIOUS: Carcinoma of the Pelvis, of the Kidney, 310.
 McKNIGHT, DOCTOR: Treatment by Tongs Extension, 124.
 McWILLIAMS, CLARENCE A.: Diverticula of the Jejunum, 135; Late Results of, Operation for Tubercular Peritonitis of, Cancer of the Ovary, 661; Methods of Free Bone Grafting, 253.
 Meckel's Diverticulum, Acute Inflammation of, 644; Strangulation of Small Intestine by, 568; Causing Intestinal Obstruction, 765.
 Megacolon, Operation for, 783.
 MEYER, WILLY: Duodenal Tube as a Means to Diagnosis, 790.
 Mesenteric Cyst, Cyst of the, 784.
 Mesenteric Embolism in an Hæmophilic, 229.
 Mesentery, Solid Tumors of the, 211.
 Metatarsal Bone, Stave Fractures of the first, 215.
 MEYER, WILLY: Chronic Empyema, 648; Late Result After Resection of the Stomach for Carcinoma, 652; Murphy Button in Intestinal Work, 649; Prevention of Gastrojejunal Ulcer after Gastroenterostomy, 657.
 MILLIKEN, SETH M.: Exostosis of Scapula, 648; Treatment of Cholelithiasis Wound, 133.
 Mikulicz Tampon, the Rubber Dam, 470.
 MORRIS, ROBERT T.: Observations on Cholelithiasis, 131.
 MOSCHCOWITZ, ALEXIS V.: Choice of Anæsthesia for Thyroidectomy, 664.
 MULLER, GEORGE P.: Tongs Extension in Treatment of Fractures, 124.
 Murphy Button, In Intestinal Surgery, 251, 649.
 Musculospiral Nerve, Late Suture of the, 665.

INDEX

Musculospiral Paralysis, 781.

MURPHY, EUGENE C.: Results of Treatment of Intracapsular Fracture of the Femur by Abduction and Plaster Fixation, 752.

N

Neck, Broken, 761.

Neck, Hygroma of, Late Post-operative Result of, 781.

NEUHOF, HAROLD: Exposure of Spinal Cord by Hemilaminectomy, 775.

Neuralgia, Supraorbital, Operation for, Under Local Anæsthesia, 779.

New York Surgical Society, Transactions of the, 128, 233, 254, 504, 659, 773, 792.

Nerve, Musculospiral, Late Suture of the 665; Ulnar, Late Suture of, 667.

Nerve-Traction to Secure Approximation, Objections to, 668.

Nervous System, Form and Functions of the Central, Tilney's Treatise on, Review of, 390.

O

OCHSNER, ALBERT J.: Cancer Infection, 294.

Oesophagus, Benign Stenosis of the, 724.

Omentum, Torsion of the, With Acute Appendix, 252.

Orthopædic Surgery, Treatise on, by Royal Whitman, Review of, 139.

Osteomyelitis, Acute Hæmatogenous, 681.

Osteomyelitis Sinus, Epithelioma in, 247.

OWEN, HUBLEY R.: Heat Stroke after Operations, 115; Recurrences after Operations for Inguinal Hernia, 641.

Ovarian Cyst, Large, in Infant, 134.

Ovary, Krukenberg Tumor of the, 481.

Ovary, Fibroma of the, 772.

P

PALMER, DUDLEY WHITE: Duodenal Ulcer in Infancy, 545.

Pancreatitis, Acute, Complicating Pregnancy, 115; Chronic, Effect of Cholecystectomy Upon, 131.

Pancreas, the Use of the Duodenal Tube in the Pre-operative Study of Infections of the, 556.

Paracelsus, by Stillman, Review of, 516.

Paralysis, Musculospiral, 781.

PECK, CHARLES H.: Operation for Megacolon, 783.

Pelvis, Suspension Treatment in Fracture of the, 125.

Pericardiotomy for Suppurative Pericarditis, 393.

Peritonitis, Tuberculous, with Cancer of Peritoneal Tuberculosis, 786.

Peptic Ulcer Subsequent to Gastroenterostomy, 434.

PFEIFFER, DAMON B.: Gastroenterostomy in Acute Perforated Ulcer of the Stomach and Duodenum, 441.

PHILADELPHIA ACADEMY OF SURGERY, Transactions of the, 111, 375, 504, 638, 760.

Picric Acid in Operative Surgery, 13.

PILCHER, JAMES TAFT: Carcinoma of the Kidney, 301.

PILCHER, LEWIS STEPHEN: Paracelsus, Review of Stillman's Life of, 516.

Pleurisy, Acute Suppurative, the Treatment of, 531.

Polycythemia, Pseudo, 223.

POOL, EUGENE H.: Dangers of Murphy Button in Intestinal Surgery, 251; Gastrojejunal Ulcer After Gastroenterostomy, 654; Pericardiotomy for Suppurative Pericarditis, 393; Ulcer of the Jejunum, Following Gastroenterostomy, 647; Cervical Rib, 787.

Prostate Cancer, Symphysiotomy as an Aid to the Removal of, 609.

Pyelitis with Ureteral Strictures, Study of Fifty Cases of, 348.

Pyloroplasty and Gastroenterostomy, Comparative Results of, in Stomach Surgery, 450.

Pyonephrosis with Late Secondary Hemorrhage, 645.

Pyopneumothorax Subphrenic, 338.

Q

QUICK, DOUGLAS: Treatment of Carcinoma of the Tongue, 716.

R

RANDALL, ALEXANDER: Congenital Valves of the Posterior Urethra, 477.

RANSOHOFF, J. LOUIS: Solid Tumors of the Mesentery, 211.

INDEX

- REEL, PHILIP J.: Gelatiniform Cancer of Breast, 108; Krukenberg Tumor of the Ovary, 481.
- Regional Anæsthesia, 165.
- REID, MONT R.: Drainage of the Common Bile Duct Through the Cystic Duct, 458.
- Renal Tuberculosis in Twins, 65.
- Rib, Cervical, 778, 787.
- ROBERTS, JOHN B.: Rational Treatment of Fractures, 385.
- ROEDER, CLYDE AUGUSTUS: Squamous-cell, Epithelioma of the Thyroid, 23.
- Röntgenographic Studies of Bronchiectasis and Lung Abscess after Direct Injection of Bismuth Mixture, 362.
- ROSS, GEORGE G.: Post-operative Endocrine Death, 112; Sliding Hernia of the Ureter, 613.
- RUGH, J. TORRANCE: Three Frequent Causes of Weak and Flat Feet, 499; Removal of Cartilaginous Body from Elbow-joint, 764.
- RUSSEL, JAMES I.: Cancer of the Large Intestine, 755.
- S**
- Saddle-back Ulcer of Central Third of Stomach, 651.
- Salernitanum, the School of, the English Version by Sir John Harrington, Review of Reprint of, 390.
- Salivary Calculus in an Acromegalic, 527.
- Sarcoma of Head of Humerus, Resection, Late Result, 236.
- Scapula, Exostosis of, 648.
- Semilunar Carpal Bone, Dislocations of the, 621; Results Following Removal of, 659.
- SEMKEN, GEORGE H.: Anastomosis in Resection of the Colon, 669; Association of Tuberculosis and Carcinoma, 662; Partial Gastrectomy for Carcinoma Under Local Anæsthesia, 662.
- SEMKEN, GEORGE H.: Fibrosarcoma of the Appendix, 797.
- SHARPE, WILLIAM: Diagnosis and Treatment of Brain Injuries with and without Shoulder, Gunshot Wound of the, 117.
- Fracture of the Skull, Review of, 137; Recurrent Dislocation of the, Partial Excision of Humeral Head for, 639.
- SISTRUNK, WALTER ELLIS: Results of Surgical Treatment of Epithelioma of the Lip, 521.
- SKILLERN, PENN G.: Pertrochanteric Fracture of the Femur, 227.
- Skin, Squamous-cell, Epithelioma of the, 141.
- Skull Fracture Followed by Intracranial Aerocele, 18.
- Snapping Jaw, Excision of the Interarticular Cartilage in Cases of, 712.
- SPEESE, JOHN: Tongs Extension in Fractures, 124.
- Spine and Spinal Cord, Surgery of the, by Charles H. Frazier, Review of, 138.
- Spleen, Hemorrhagic Cysts of the, 58.
- Stenosis, Congenital, of the Colon, 125.
- STEPHENS, RICHMOND: Tibial Tubercle Affections, 77.
- STERART, FRANCIS T.: Manual of Surgery, Review of, 800.
- STETTEN, DEWITT: Association of Tuberculosis and Carcinoma, 662; Multiple Diverticula of the Upper Ileum, 241.
- ST. JOHN, FORDYCE BARKER: Peritoneal Tuberculosis, 786.
- STEWART, WILLIAM H.: Röntgenographic Studies of Bronchiectasis and Lung Abscess After Direct Injection of Bismuth Mixture, 362.
- STILLMAN, JOHN MAXSON: Biography of Paracelsus, Review of, 516.
- Stomach, Carcinoma of, Late Result After Resection for, 652; and Duodenum, Acute Perforated Ulcer of Gastroenterostomy in, 441; Saddle-back Ulcer of, Central Third of, 651; Operation for Carcinoma of, Under Local Anæsthesia, 662; Ulcer of, Associated with Hodgkin's Disease, 670; Ulcer of Mid-third of, Sleeve Resection for, 654.
- Stomach Surgery, Pyloroplasty and Gastroenterostomy in, 450.
- Streptococcus Hæmolyticus, Importance of, Infected Wounds, 4.
- Subphrenic Abscess, 338.
- Surgery: Ashhurst, A. P. C., Treatise by, Review of, 519.
- Surgical Pathology and Morbid Anatomy, Bowlby and Andrews, Review of, 518.
- Surgery, Text-book of, Edited by George C. Gask and Harold W. Wilson, Review of, 139.

INDEX

SWEETSER, HORATIO B.: Injury to the Bile-ducts and Methods of Repair, 629; Bacteriology of Infected Wounds, 4.
Symphysiotomy as an aid to the removal of Cancer of the Prostate, 609.

T

Tampon, the Gibson-Mikulicz, in Acute Appendicitis, 470-473.
TAYLOR, KEMPTON P. A.: Sliding Hernia of the Ureter, 613.
TAYLOR, A. S.: Objections to Nerve Trac-tion to Secure Approximation, 668; Birth Palsy, 773; Cervical Rib, 778; Dam-age by Bilateral Laminectomies, 776; Mus-culospiral Paralysis, 781; Post-operative Abdominal Adhesions and Anomalous Membranes, 776; Removal of Gasserian Ganglion, Under Local Anæsthesia, 779.
THOMAS, T. TURNER: Loose Cartilage in Knee-joint, 764; Treatment of Intracup-sular Fracture of the Neck of the Femur, 767; Intussusception, 638; Recurrent Dis-location of the Shoulder, 639; Stran-gulation of a Recurring Inguinal Hernia, 641.
THOMPSON, J. OSCAR: Tumors in South China, 217.
Thyroidectomy, Choice of Anæsthesia for, 664.
Thyroid Cases, Laryngeal Functions in, 321.
Tibia, Bone Graft of, for Non-Union, 245.
Tibia and Fibula Fracture of, with Non-Union, Treatment of, 124.
Tibial Tubercle Affections, 77.
TILNEY, FREDERICK AND RILEY, HENRY
ALSO: Form and Functions of the Cen-tral Nervous System, Review of, 390.
Tongs Extension in Fractures, 124.
TOREK, FRANZ: Bone Graft of Humerus, 244; of Tibia, 245; Use of Murphy But-ton in Intestinal Surgery, 251.
Tongue, Carcinoma of the, Treatment of, 716.
Tuberculosis of the Peritoneum, 786.
Tuberculosis and Carcinoma, Association of, 661.

Tubercular Peritonitis with Cancer of Ova-ry, Late Result of Operation for, 661.
Tuberculosis, Renal, in Twins, 65.
Tumors in South China, 217; Solid, of the Mesentery, 211.
Thyroid, Squamous-cell Epithelioma of the, 23.

U

Ulcer, Mid-Gastric, Sleeve Resection of, 654; of Stomach, Complicating Hodg-kin's Disease, 670.
Ulcers of Stomach and Duodenum, 328.
Ulnar Nerve, Late Suture of, 667.
Ununited Fracture of the Leg, Treatment of, 124.
Ununited Fractures, the Treatment of, 487.
Urachus, Patent, With Sarcoma, 643.
Ureter, Sliding Hernia of the, 613.
Ureteral Strictures and Pyelitis, Study of Fifty Cases of, 348.
Urethra, Posterior, Congenital Valves of the, 477.

V

VAN BEUREN, FREDERICK T. JR.: Experi-ences with the Murphy Button at Roose-velt Hospital, 650.
Venereal Diseases by I. E. R. McDonagh, Review of, 519.
Vertebra, Lumbar, Compression Fracture of, With Delayed Symptoms, 360.
Vertebral Column, Fracture of the, 770.
Vesalius, Sechs Anatomische Tafeln, Reprint of, Review of, 388.
VIVIAN, CHARLES S.: Operative Treatment of Gonorrheal Epididymitis, 357.
VOSBURGH, A. S.: Cholecystectomy, 131; Gunshot Wound of the Abdomen, 129.

W

WALKER, GEORGE: Symphysiotomy as an Aid to the Removal of, Cancer of, the Prostate, 609; the Secretory Pressure of the Kidneys, as an Index of Pathological Conditions, 610.
WALKER, JOHN B.: Bone Grafting in the United States Army Hospitals, 1, 255.
Wharton's Duct, Calculus in, 377.

INDEX

- WHEEDEN, W. M.: Treatment of Acute Suppurative Pleurisy, 531.
- WHIPPLE, ALLEN O.: Indications for Local Anæsthesia, 663; Saddle-back Ulcer of Central Third of Stomach, 651; the Use of the Duodenal Tube in the Pre-operative Study of Infections of the Biliary Tract, 556.
- WHITMAN, ARMITAGE: Review of Basset on the Neck of the Femur, 256.
- WHITMAN, ROYAL: Reconstruction Operation for Ununited Fracture of the Femur, 245; Removal of the Astragalus, After Chopart's Amputation, 252; Results Following Removal of Semilunar Bone, 659; Treatise on Orthopædic Surgery, Review of, 139.
- WIENER, JOSEPH: Operation for Papilloma of Bladder, 240.
- WILENSKY, ABRAHAM O.: Broncho-Pulmonary Fistula, 30.
- WILENSKY, ABRAHAM O.: The Present Status of Gastric and Duodenal Ulcer, 420.
- WINSLOW, RANDOLPH: Subphrenic Pyopneumothorax Abscess, 338.
- WOOLSEY, GEORGE: Gastrojejunal Ulcer after Gastroenterostomy, 655; Gastrectomy Under Local Anæsthesia, 663; Intestinal Anastomosis, 669; Late Results of Removal of Carcinoma of the Transverse Colon, 660; Observations on Cholelithiasis, 46; Sleeve Resection of Mid-Gastric Ulcer, 654; Absence of Gall-Bladder, 792.
- Wounds Infected, Bacteriology of, 4.
- Wounds, Determining the Superficial Area of by a Gravimetric Method, 673; Open Infected, Treatment of, 701.

WHY CHINOSOL

IS THE BEST ANTISEPTIC

ITS WIDE THERAPEUTIC SCOPE AND GREAT SUPERIORITY ARE BECAUSE IT IS

- 1 More powerful than bichloride
- 2 Non-poisonous
- 3 Does not coagulate albumin
- 4 Does no injury to membranes
- 5 Does no damage to tissues
- 6 Does not break down granulation
- 7 Causes no irritation
- 8 Possesses marked analgetic power
- 9 A promptly efficient deodorant
- 10 Allays inflammation

ACCEPTED BY COUNCIL ON
PHARM. AND CHEM., A. M. A.

A SAMPLE TO ANY PHYSICIAN AND
LITERATURE SHOWING WHAT
CHINOSOL HAS ACCOMPLISHED



Valentine's Meat-Juice

Before and after Surgical Operations when the Stomach is Rejecting Food and it is Essential to Conserve the Vital Forces, Valentine's Meat-Juice demonstrates its Ease of Assimilation and Power to Restore and Strengthen.

John Keay, Medical Officer in Charge Edinburgh War Hospital, Edinburgh, Scotland: "The VALENTINE'S MEAT-JUICE has been used in this Hospital, and in cases of extreme exhaustion from sickness or wounds has been found a stimulant and food of great value."

Dr. E. Duloir, Physician Accoucher to the International Hospital, Paris, France: "A young accouchée, in a very weak condition and suffering from stomach trouble, could retain no food, but was able to assimilate VALENTINE'S MEAT-JUICE given at first in small doses. An improvement was quickly visible, the patient recovered her strength and is to-day in good health."

For Sale by American and European Chemists and Druggists

VALENTINE'S MEAT-JUICE CO.

A. N. C. RICHMOND, VIRGINIA, U. S. A.



The Winkley Artificial Limb Co.

Largest Manufactory of Artificial Legs in the World

Inventors and Manufacturers of the

LATEST IMPROVED

PATENT ADJUSTABLE

DOUBLE SLIP SOCKET

Artificial Leg

Warranted not to Chafe the Stump

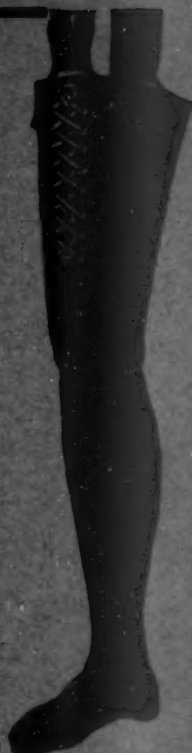
PERFECT FIT GUARANTEED from Casts and Measurements
without leaving home

Thousands of our Slip Socket Legs now being worn

United States Government Manufacturers

Send for Illustrated Catalogue

MINNEAPOLIS, MINN., U. S. A.



Pituitary Liquid

is the perfect preparation of Posterior Pituitary active principle. It, too, is without preservatives— $\frac{1}{4}$ c. c. obstetrical, 1 c. c. surgical.

Corpus Luteum

(Armour)

is true substance and will give results. Powder 2 and 5 gr. capsules and 2 and 5 gr. tablets.

Surgical Catgut Ligatures

Plain and chromic, regular (60 inch) emergency (20 inch) iodized (60 inch)

Strong and sterile.



An Incomparable Product

The Suprarenalin preparations are now available.

Suprarenalin Powder - - - 1 grain vials

Suprarenalin Solution, 1:1000 - 1 oz. bottles

Suprarenalin Ointment, 1:1000 - - tubes

Suprarenalin designates the astringent, hemostatic and pressor principle of the Suprarenal Gland as isolated by the Armour chemists.

Suprarenalin Solution is the incomparable preparation of the kind. It is water-white, stable and non-irritating and is entirely free from chemical preservatives.

Suprarenalin ointment is bland and its effects very lasting.

ARMOUR & COMPANY
CHICAGO

